AUSTRALIA IN THE WAR OF 1939-1945

SERIES FIVE

MEDICAL

VOLUME IV

MEDICAL SERVICES OF THE R.A.N. AND R.A.A.F.

AUSTRALIA IN THE WAR OF 1939-1945

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MEDICAL SERVICES OF THE R.A.N. AND R.A.A.F.

WITH A SECTION ON WOMEN IN THE ARMY MEDICAL SERVICES

by

ALLAN S. WALKER
M.D., Ch.M., F.R.A.C.P.

AND OTHERS

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ABBREVIATIONS USED IN REFERENCES

A.A.M.C.—Australian Army Medical Corps.
A.A.M.W.S.—Australian Army Medical Women's Service.
A.A.N.S.—Australian Army Nursing Service.
A.A.S.C.—Australian Army Service Corps.
A.B.D.A.—American, British, Dutch, Australian.
A.C.S.—Airfield Construction Squadron.
A.D.M.S.—Assistant Director Medical Services.
A.F.C.—Australian Flying Corps.
A.G.H.—Australian General Hospital.
A.O.B.—Advanced Operational Base.
A.R.P.—Air Raid Precautions.

B.A.G.S.—Bombing and Gunnery School.

C.A.F.—Citizen Air Force.
C.C.S.—Casualty Clearing Station.
C.M.B.—Central Medical Board.
C.P.O.—Chief Petty Officer.

D.—Deputy, Dental.
D.A.D.M.S.—Deputy Assistant Director Medical Services.
D.D.M.S.—Deputy Director Medical Services.
D.D.S.—Director Dental Services.
D.D.T.—Dichloro-diphenyl-trichlorethane.
D.E.M.S.—Defensively Equipped Merchant Ships.
D.G.M.S.—Director-General Medical Services.
D.M.S.—Director Medical Services.
D.N.M.O.—Depot Naval Medical Officer.
D.N.M.S.—Director Naval Medical Services.
D.O.A.P.—Developmental Over-all Plan.

E.A.T.S.—Empire Air Training Scheme.
E.F.T.S.—Elementary Flying Training School.
E.P.I.P. tent—European Privates Indian Pattern tent.

F.P.R.C.—Flying Personnel Research Centre.
F.P.R.U.—Flying Personnel Research Unit.

I.C.R.C.—International Committee of the Red Cross.
I.T.S.—Initial Training School.

L.A.S.U.—Local Air Supply Unit.
L.C.P.—Landing Craft Personnel.
L.C.V.P.—Landing Craft Vehicle—Personnel.
L.H.Q.—Allied Land Forces Headquarters.
L.S.B.A.—Leading Sick Berth Attendant.
L.S.I.—Landing Ship, Infantry.
L.S.T.—Landing Ship, Tank.

M.A.E.T.U.—Medical Air Evacuation Transport Unit.
M.C.S.—Medical Clearing Station.
M.D.S.—Main Dressing Station.
M.F.C.U.—Mobile Fighter Control Unit.
M.L.O.—Medical Liaison Officer.
M.R.S.—Medical Receiving Station.
M.R.U.—Medical Rehabilitation Unit.

N.H.—Naval Hospital.

O.B.U.—Operational Base Unit.
O.C.—Officer Commanding.
O.T.U.—Operational Training Unit.

P.D.O.—Principal Dental Officer.
P.M.O.—Principal Medical Officer.

Q.A.I.M.N.S.—Queen Alexandra's Imperial Military Nursing Service.

R.A.A.F.—Royal Australian Air Force.
R.A.F.—Royal Air Force.
R.A.N.—Royal Australian Navy.
R.A.N.N.S.—Royal Australian Naval Nursing Service.
R.A.N.V.R.—Royal Australian Naval Volunteer Reserve.
R.A.P.—Regimental Aid Post.
R.A.P.W.I.—Repatriation of Allied Prisoners of War and Internees.
R.C.A.F.—Royal Canadian Air Force.
R.D.F.—Radar (or Radio) Detection Finding.
R.M.O.—Regimental Medical Officer.
R.N.—Royal Navy.
R.N.N.—Royal Netherlands Navy.
R.N.Z.A.F.—Royal New Zealand Air Force.

S.B.A.—Sick Berth Attendant.
S.D.O.—Senior Dental Officer.
S.E.A.C.—South-East Asia Command.
S.M.O.—Senior Medical Officer.
S.T.T.—School of Technical Training.
S.W.P.A.—South-West Pacific Area.

T.A.F.—Tactical Air Force.

U.R.T.I.—Upper Respiratory Tract Infection.
U.S.N.—United States Navy.

V.A.D.—Voluntary Aid Detachment.

W.A.A.A.F.—Women's Auxiliary Australian Air Force.
W.A.G.—Wireless Operator/Air Gunner.
W.E.—War Establishment.
W.R.A.N.S.—Women's Royal Australian Naval Service.
W.T.—Wireless Telegraphy.

Y.W.C.A.—Young Women's Christian Association.

PREFACE

IN November 1956 ill-health compelled Dr Allan Seymour Walker to relinquish his work as author of the Australian Medical War History. After a long period in hospital, he died on 8th January 1958. He left behind a monument to his skill, devotion and industry. After about five years of research and writing, carried on under considerable practical difficulties, in 1950 he completed *Clinical Problems of War,* in its field perhaps a more comprehensive work than had ever been written by a single hand. In the next year *Middle East and Far East* was finished, and three years later *The Island Campaigns.* In the last few years of this heavy task his load was somewhat lightened by knowledge of the esteem and gratitude with which his books were being received both in Australia and overseas.

When Allan Walker had to cease work *The Island Campaigns* was in proof, he had drafted a history of the medical service of the Royal Australian Navy, and had completed a number of other papers, notably one on Hospital Ships which had been read to the Australasian Medical Congress held in Melbourne in 1952. The story of the women's services in the Australian Army Medical Corps, however, was far from complete, and the editing of the history of the medical service of the Royal Australian Air Force not begun. Allan Walker's role in the production of the air force medical history would have been that of editor rather than author because, as a result of the foresight of Air Vice-Marshal Victor Hurley, a group of air force medical officers, led by Wing Commander Grayton Brown, in 1945 and 1946 had written a series of thorough narratives concerning the experiences and problems of their service throughout the war. Hurley intended that these should form the basis of the air force section of the medical war history.

These narratives were condensed and rearranged in a sequence similar to the one that Allan Walker had employed in his chapters on the naval medical service. The Director-General of the Air Force Medical Services, Air Vice-Marshal E. A. Daley, lent his enthusiastic support in matters large and small, and he and members of his staff and a large number of past or present R.A.A.F. medical officers, including the late Sir Victor Hurley and others mentioned below, read, corrected and amplified the draft chapters. Part II of this volume is very much a cooperative effort, with the major professional contribution being made by Squadron Leader Lloyd Buley, who re-edited the whole section and made many additions.

The Medical Director-General of the Royal Australian Navy, Surgeon Rear-Admiral L. Lockwood, members of his staff, and a number of former naval medical officers gave similar help with the revision and expansion of the naval chapters.

In its present form Part III of this book is the work of Mrs Gwen Jacobson, who is responsible also for the writing of much that is included in the other sections, for the organisation of the whole volume and its

preparation for the printer, and finally for the compilation of the index. For a time she had the help of Miss Sylvia Mossom, particularly with the chapter on rehabilitation and with the expansion, using the reports of the Flying Personnel Research Committee, of the chapter on aviation medicine. This chapter was later critically examined and further expanded by several authorities, notably Air Vice-Marshal Daley, Dr Hugh Ryan, and Squadron Leader Buley.

As Allan Walker explained in the preface to *Clinical Problems of War,* the medical services of the navy and air force as well as those of the army contributed to the information used in that volume, but "more detailed accounts of some subjects of special interest to medical officers of the navy and air force" would be given in the present volume. To this extent, therefore, the present volume is to be regarded as complementary to the earlier one, in much the same way as the second and third volumes of this series are. And, in common with the other volume, this one "does not pretend", as Allan Walker wrote in an earlier preface, "to cover the whole of any subject, but it records Australian experience, the methods found valuable, the successes and the failures. It stops short at the end of 1945, and it touches only the barest fringe of post-war experience, for this is beyond its ambit." A United Kingdom medical historian has referred his readers to the Australian medical historian's account of the experiences of the prisoners of the Japanese as being the main one, to which his was but complementary; in the same way many sections of this volume should be regarded as complementary to the corresponding parts of the volumes that relate the history of the medical services of the Royal Navy and Royal Air Force.

Each of the four parts that comprise this book are self-contained and consequently there is some repetition. Some important episodes are described in the naval section and then, from a different point of view, in the air force section, and perhaps again, from still another point of view, in the chapter on the Army Nursing Service, and so on.

Thanks are due to the following doctors in addition to those mentioned above:

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GAVIN LONG.

Canberra,
10th December 1959.

PART I

MEDICAL SERVICES OF THE R.A.N.

CHAPTER 1

BUILDING THE NAVAL MEDICAL SERVICE

THE Royal Australian Navy in methods and tradition was based closely on its parent Service, the Royal Navy, and the R.A.N. Medical Service in its early years was a reproduction on a small scale of the medical service of the R.N., both as regards material and personnel. Its medical branch was at first administered by a medical officer on loan from the Royal Navy. During the 1914-18 War the medical officers of the Service never exceeded 24, and were permanent officers or short-service medical officers entered for the period of the war only. The sick-berth staff consisted of ratings on loan from the Royal Navy or transferred to the Royal Australian Navy from the Royal Navy, together with local recruits some of whom received a course of training in the United Kingdom. One nursing sister was attached to the Royal Australian Naval College at Jervis Bay; otherwise, nursing duties were carried out exclusively by male nurses. Men serving on the Australia Station who needed prolonged hospital treatment were accommodated at the Caulfield Repatriation Hospital in Melbourne or in a separate ward at St Vincent's Hospital, Sydney. Those needing specialist investigation were sent to various specialists in the capital cities of the Commonwealth with whom the navy had agreements. A similar procedure was followed for men needing dental treatment, at least during the first two years of the war. When Australian ships served overseas Royal Navy facilities were used.

The various scales of drugs and equipment and all medical forms and journals were similar to those used by the Royal Navy, and any change in medical procedure brought about by Admiralty Fleet Orders was adopted by the Royal Australian Navy, although sometimes adapted to meet local conditions.

As all serious cases of medical interest were sent to Royal Navy, civil or repatriation hospitals, R.A.N. doctors were given little opportunity of increasing their medical knowledge. It is true that the naval ward at Caulfield Repatriation Hospital was under the charge of R.A.N. doctors and that the nursing was carried out by R.A.N. sick-berth staff, but even there operations of a serious nature were performed by visiting specialists and that feeling of isolated responsibility, which is necessary for the production of fully-competent medical officers, was lacking.

Procedures, such as X-ray and pathological and radiological investigations, were carried out by non-naval personnel and no serious attempt was made to train sick-berth ratings in these fields. X-ray apparatus and pathological equipment supplied to ships were of simple type and no investigations other than those of a straightforward nature were possible on board.

In spite of all these disadvantages the small R.A.N. Medical Service did excellent work, and its members, because of the isolated service of

Australian ships in many parts of the world and the absence of many facilities now considered essential, possibly faced greater problems than the medical officers who served in the war of 1939-45.

In the first chapter of the second volume of this history some matters of policy were outlined concerning the Naval Medical Service during the period 1919-39. These included preparations for war, and in particular the suggested unification of the medical branches of the three armed Services. Though considerable pressure was exerted by the supporters of unification, the navy never assented to the principle. Opinion appeared to be divided among the civil branches of the medical profession: unification would provide certain advantages of administration, but there would be disadvantages too, the chief being the submergence of the special needs of a small Service.

The Naval Medical Service had little professional encouragement during this period. Capable and energetic doctors hesitated to join a service where few opportunities existed for professional advancement or for the acquisition of further medical knowledge. The natural psychological reaction against a uniformed and disciplined service, which sometimes follows a long war, was an additional factor in inhibiting the entry of suitable doctors and sick-berth staff.

Favourable changes came, but only slowly. In 1921 a conference between the Department of the Navy and the British Medical Association resulted in a readjustment of pay and conditions of the permanent medical branch, though there was still insufficient inducement to medical men to adopt the Royal Australian Navy as a career. The opening of Flinders Naval Hospital and the taking over of a ward at the Randwick Repatriation Hospital, Sydney, gave naval doctors opportunities of carrying out major surgery and attending to naval cases of a serious nature. Facilities for the training of sick-berth staff were provided at these centres, and gradually a competent sick-berth staff was produced.

In 1927 an Australian naval medical officer, Surgeon Captain L. Darby, became Director of Naval Medical Services, and many beneficial changes were brought about during his period of office. The R.A.N. Medical Branch began to stand on its own feet, and deviations from Royal Navy procedure and routine were introduced which were suited to Australian conditions.

Specialisation by naval doctors was encouraged by increases of pay for those qualified in such subjects as pathology, surgery and genito-urinary work. Expansion of the dental services, including the provision of prosthetic facilities, also occurred in this period.

An important step forward was the training of selected sick-berth staff in X-ray, pathological and operating-theatre work. This was done at the Alfred Hospital, Melbourne, where many excellent technicians were turned out to the advantage of the navy and the men themselves.

In 1932, however, conditions of service were still unsatisfactory in some respects. A report made at his retirement by Surgeon Commander W. E. Roberts, R.A.N., called attention to disabilities under which medical

officers of the navy had to work. The Federal Committee of the British Medical Association discussed this in February 1932, and on 9th April 1932 a leading article in the *Medical Journal of Australia* stated that the pay for medical officers in the R.A.N. was inadequate, and below that in the Royal Navy: for instance, there was no "charge pay", as allowed in the R.N., for added responsibilities of administration of various units. Opportunities for promotion were limited, and no substantive rank higher than that of surgeon commander was granted. More serious was the curtailment of post-graduate work, with limitation of professional advancement.

In 1932 Surgeon Captain W. J. Carr succeeded Surgeon Captain Darby as D.N.M.S. The next few years saw an expansion of the navy and a corresponding broadening of the medical service with more intensive use of specialists. Carr continued to control the medical branch of the R.A.N. until 1946, when he retired with the rank of surgeon rear-admiral.

To meet the eventuality of a sudden onset of war it was essential that adequate numbers of medical and dental officers and sick-berth staff should be available to fill ships' war complements, as well as a surplus to replace casualties or those medically unfit for mobilisation. It was also necessary to have a percentage of medical officers qualified to act as specialists in surgery, ophthalmology, aural surgery, radiology, pathology and, in view of the later advent of women into the fighting Services, gynaecology. Such a reserve would provide a pool of keen men in active practice whose influence would be professional as well as technical.

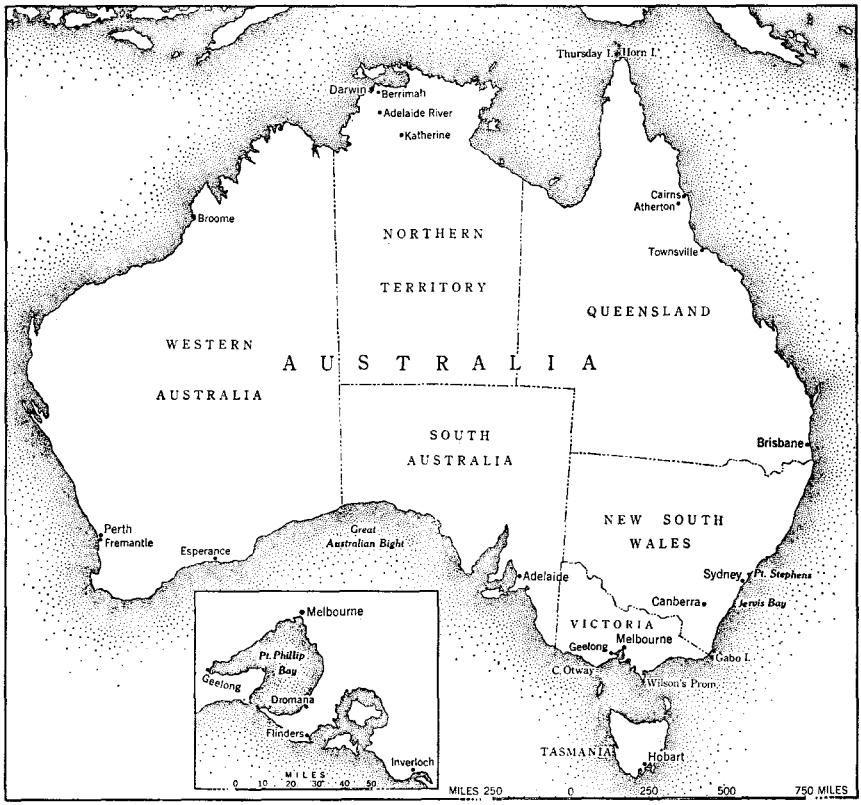
The Naval Medical Service began building up its reserve list after the Munich crisis in 1938. When war broke out in September 1939 there were only 32 medical officers listed in the reserve forces, less than half the requirements of the first two years of war, but by October 1941 the number had increased to 74.

The Naval Medical Service did not, either at the outbreak of war or during the war, have many recognised specialists in any branch. They had, for instance, only two ophthalmologists, and no aural surgeon or pathologist. As regards surgery, the service was fortunate in finding some half-dozen competent young doctors of sufficient skill and experience to meet the surgical demands of the R.A.N.—demands which were by no means light.

Apart from the specialist, the type of doctor most suitable for naval service was the young graduate with some experience of hospital work, who was able to fit himself into the surroundings of a small ship such as a destroyer or sloop. To do this successfully he needed an equable temperament and a stable digestive system, together with the ability to meet any medical or surgical emergency. All doctors in the navy had to be able, to some extent, to carry out operative procedures, because in small ships they were frequently isolated at sea in remote areas where they had to depend on their own resources. During the war a number of

major operations were performed on board ship with, for the most part, successful results.

In assessing how many doctors were required, a peacetime figure was fixed for each ship and naval depot, and this figure was increased in war.



On the outbreak of war the R.A.N. had sufficient doctors available for its immediate needs and mobilisation proceeded smoothly, although some medical officers later found it necessary to obtain brief periods of temporary demobilisation to make arrangements about practices left in haste, or to attend to urgent private affairs. As the war progressed the availability of doctors continued to be satisfactory. The Royal Navy was less fortunate, despite the impetus given to medical planning by the Italo-Abyssinian War and the Munich crisis. In the words of the R.N. historian "the Medical Branch of the Royal Navy entered the war of 1939-45 handicapped from the beginning by a numerical nightmare from which it never fully recovered". While the number of doctors in the Service rose from less than 400 in 1939 to 2,610 at the end of the war, the increase did not keep pace with the increase in the total force and the

proportion of medical officers to other personnel declined from the peacetime figure of 4 per 1,000 to 3 per 1,000 in 1945.

To ensure a satisfactory distribution of available medical manpower between the various branches of the defence forces and the civil community it was necessary to control the supply of medical officers, which meant virtual conscription of the medical profession. Even before the outbreak of war most of the machinery was in existence for the purpose. In July 1938 the Central Medical Coordination Committee met for the first time, and the distribution of medical officers between the armed forces and the civil community was delegated to this body and distribution between the three Services to the Standing Committee of Service Medical Directors.

The system adopted permitted all new graduates to volunteer for whatever Service they preferred, and they were allocated as far as possible to the Service of their choice. Compared with the army and air force the needs of the navy were small; consequently many doctors who named the navy as their first choice had to be allocated to their second preference. There was never a shortage of volunteers for the Naval Medical Service, especially in Victoria and South Australia, and for every one accepted at least two had to be refused. The navy possessed some slight advantage over its sister Services in that young graduates were not called up until from six to eighteen months after graduation, and thus were able to occupy hospital appointments or act as *locum tenens* while awaiting call-up. Although such delays were frustrating to young men anxious to get into the front line, the experience gained undoubtedly increased their value to the Service.

On call-up a medical officer received the rank of surgeon lieutenant and was appointed to Flinders Naval Depot or to one of the Sydney establishments for a period of from three to six months to gain experience of naval regulations, customs and traditions. He was then appointed to a seagoing ship for about two years, after which, if possible, he was again transferred ashore where he could keep in touch with his professional work either at naval or civil hospitals, and by attending combined technical demonstrations and meetings of doctors.

As mentioned, service at sea, although often exciting enough in wartime, did not offer very many professional opportunities to medical officers except after action, and then the amount of work they were called upon to perform might be overwhelming. Transfers were arranged as frequently as was compatible with efficiency to give them variety of professional experience, but the isolated nature of medical service inevitable in a navy did not readily permit this, and medical officers, like others on distant stations, often had long and sometimes monotonous periods of service. On the other hand, the independence and responsibility of the life was in itself an education.

The Director of Naval Medical Services encouraged medical officers to report cases of interest or importance or any unusual medical events

and, should their nature warrant it, to publish articles about them in current scientific journals. Medical pamphlets issued by the Medical Research Council in England were circulated, and a series of technical medical instructions issued by the R.A.N., drawing the attention of medical officers to methods of recognising and treating various conditions. These instructions covered a wide range of subjects, including war wounds, fracture of the carpal navicular bone, venereal disease from both prophylactic and therapeutic standpoints, X-ray reports on chest conditions, details of a venomous *Medusa* found in tropical waters, blood transfusion and technical details about blood banks, surgical operations on board H.M.A. ships, seasickness, treatment of phosphorous burns, poisoning by nitrous fumes, sulphonamides and nervous tissue, psychiatric first aid, examination of the eyes of prospective entrants of the various sections of the navy and of personnel already entered, treatment of gas casualties, glandular fever, scrub typhus and scrub itch, tropical ear (*otitis externa*), meningococcaemia, the use of penicillin, and cholera and the use of cholera vaccine.

At an early period of the war the Admiralty inquired whether any Australian medical officers could be lent to the Royal Navy, and the Australian Government permitted 12 to go to the United Kingdom. Most of these officers served in the Royal Navy throughout the war. One of them, Surgeon Lieutenant D. N. McKenzie, was lost in H.M.S. *Quorn* in the English Channel on 3rd August 1944. Later a further request was made by the Admiralty, but by then it was realised that Australia could spare no more doctors and a negative answer had to be given. New construction and the opening of new bases had increased the demand for medical officers, and by July 1944 198 were included in *The Navy List,* and a reserve of from 12 to 15 was maintained to replace casualties and to fill new appointments, members of the reserve being recruited from new graduates. The system needed careful budgeting by the Director of Naval Medical Services to avoid having too many or too few available.

The male sick-berth staff was the backbone of the nursing service of the R.A.N. The naval sick-berth rating, unlike the army and air force medical orderly, was not generally replaceable by a female nurse, for a very large proportion of the nursing of naval sick and wounded took place in the ships, where only male nurses could be carried. He, himself, was in every sense of the word a nurse, and frequently a highly competent one.

Indeed when the formation of a nursing service was proposed it was argued by some that it would lower the standard of the male nurses, for no man could be expected to be a competent nurse in the sick bay of a ship unless he had had experience and responsibility in a shore hospital, and the presence of nursing sisters might deprive him of this opportunity.

Recruits to the sick-berth branch were given a period of initial training in the new-entry school, which consisted mostly of a disciplinary course, followed in peacetime by 45 weeks of medical training at the depots, this

period being reduced during the war to 12 weeks. The medical training consisted of lectures, ward work and practical demonstrations, the lectures covering first aid, anatomy, physiology, general nursing, rough diagnosis of disease, dispensing, cooking and the compilation and rendering of accounts. Recruits also had to attend parades, and Surgeon Captain Darby and some officers concerned in training thought that this took up time which might have been better spent in ward work.

It was customary after this course to draft ratings to sea for experience. On their transfer to a ship training was intensified, and the medical officer and senior staff gave freely of their knowledge to ensure that when the occasion arose a perfect working machine would be available. The training covered (*a*) preparation of plasma for administration at short notice, (*b*) tourniquets and their application, (*c*) versatility of the triangular bandage, (*d*) ability to distinguish between a seriously wounded man and one less seriously wounded, (*e*) administration of morphia, (*f*) speedy transport of casualties. Medical parties were included in lectures on subjects (*b*) to (*f*), while two picked ratings were instructed in (*a*) until they were thoroughly conversant with the subject. Used sets of the American type of outfit were used for practice in the administration of plasma.

An important feature in this training was the fostering of a spirit of independence and responsibility, which was essential to work in small ships. Because of their heavy responsibility, Surgeon Lieutenant S. E. L. Stening of *Perth* recommended that sick-berth attendants under the rank of leading sick-berth attendant should not be sent to small ships.

After a period at sea ratings returned to the depot for revision, and to sit for the examination for leading sick-berth attendant, though this was not essential as the examination could be carried out at sea. It could not be taken, however, until ratings had been 12 months in the service.

A minimum of two years' service, as well as success in the qualifying examination, was necessary for promotion to sick-berth petty officer. The next grade was sick-berth chief petty officer, to qualify for which candidates had to sit for a special examination in X-ray, general administration and typing.

In 1945 the highest rank held in the sick-berth branch was that of wardmaster lieutenant; there were also commissioned and warrant wardmasters. Officers were specially selected and had to pass a very detailed examination in general hospital administration and organisation.

Specialist courses in pathology, X-ray and operating-theatre technique were open to sick-berth staff, but the numbers allowed to take them were restricted to a quota basis. These courses were generally of six months' duration and were carried out at the Alfred Hospital, Melbourne, under specialists of that hospital. Experience showed that those who had successfully completed these courses were eagerly sought by civil authorities after their discharge.

In September 1939 sick-berth staff numbered 59. The expansion necessitated by war was achieved by the mobilisation of reserves, who were immediately drafted to the various ships and shore establishments.

The training of the reserve sick-berth branch had not been seriously undertaken until 1935. It was then realised that if they were to be of any value these men must have as intensive a training as could be devised in the short time available. Two competent instructors from the permanent forces were drafted to the reserve depots at Melbourne and Sydney, and regular systematic courses of instruction were instituted, including actual work in the out-patients' departments of civil hospitals. The reservists were often men whose enthusiasm for medical work had previously led them to seek experience with civilian ambulance and first-aid organisations, and it did not take them long to become proficient sick-berth ratings.

The numbers of sick-berth staff carried in ships had been increased considerably after the 1914-18 War, but never approached the numbers carried by ships of the American Navy. Cruisers of the *Australia* type carried 6 or 7 ratings, including a chief petty officer or petty officer, an X-ray technician and a rating specially trained in operating-theatre work. The Landing Ships Infantry carried the same complement, but would have needed more had they been used as hospital carriers. Sloops of the *Yarra* class and *Moresby* carried 2 or 3.

Destroyers after 1942 carried one sick-berth rating each and later in the war 2, including a leading sick-berth attendant and one sick-berth attendant; corvettes of the *Bathurst* class and frigates such as *Diamantina* carried one.

Members of the sick-berth branch did responsible work not only at sea but in isolated establishments on shore, for example, in port war signal stations, where they were required to carry out all such duties as, in civilian hospitals, would be performed by highly trained nursing sisters. It was necessary for them to be able to recognise the more common diseases, or at any rate to decide whether a man was seriously ill or not, and on occasions they had to act on their own initiative until such time as a medical officer became available. Their work therefore demanded plenty of commonsense and a reasonable amount of technical knowledge. Acute appendicitis was seen with relative frequency in ships, and here S.B.A's needed to be able to make a tentative diagnosis. S.B.A. Cranston of *Glenelg* reported that he had seen nine cases of acute appendicitis evacuated and operated on in two months.

As mentioned, sick-berth ratings were also drafted to base establishments. In September 1941 27 sick-berth ratings were employed at *Cerberus,* only three of whom had received peacetime training, the proportion of trained sick-berth attendants to patients being one to 47. Most of the others were relatively untrained, yet at this time patients were passing through in large numbers. Often they were suffering from infectious diseases or had been admitted for observation and investigation, conditions which required skilled handling. Another difficult problem was the supervision of wards at night. At Naval Wing, Randwick, a shortage

of sick-berth staff made itself felt in the wards soon after the beginning of the war when members of the sick-berth staff who were trained in clerical work had to be detached for the very important duty of keeping records.

Hygiene was a special branch of work which was carried out by sick-berth staff. The first hygiene section instituted by the R.A.N. was in charge of a reservist, Warrant Wardmaster F. W. Crane.

By the end of the war the sick-berth branch numbered 546; 13 had been killed in action or died of wounds; one other was missing and presumed dead. Members of the branch, even those with limited wartime training, had proved themselves capable of doing highly-skilled work, and the manner in which they carried out their duties earned them the commendation of their commanding officers and the respect and gratitude of their shipmates. This was underlined by the generally excellent reports of their behaviour in action and the decorations awarded them.

The Women's Royal Australian Naval Nursing Service was formed in 1942, with conditions of service similar to those of the Australian Army Nursing Service. Miss Ina Laidlaw was the first Matron. As mentioned, careful thought had been given to the possible adverse effects which the formation of the service might have on the male sick-berth branch, but it was agreed that the experiment was fully justified by the results. R.A.N. nurses were posted to naval hospitals and sick-quarters throughout Australia and in New Guinea and they maintained a high standard of nursing practice wherever they went. Their work will be described in a later chapter.

Physiotherapy facilities were also provided in the R.A.N. In October 1943 three trained female physiotherapists were appointed—two to Flinders Naval Hospital and one to Sydney. The physiotherapists entered the navy under the same conditions as the nurses, held equivalent ranks, and wore somewhat similar uniforms. In addition, a bacteriologist was appointed to the staff of Flinders Naval Hospital and, with other female specialists, was allotted the same accommodation as the nurses. She and the physiotherapists soon became integral parts of the hospital organisation.

The formation of the Women's Royal Australian Naval Service in 1941 involved the training of W.R.A.N. sick-berth staff, as it would obviously have been uneconomical to employ trained nursing sisters in the treatment of the minor ailments of W.R.A.N. personnel. The formation of the W.R.A.N.S. also necessitated the setting aside of special wards for women in the large shore establishments, and even in relatively small sick-quarters an adequate number of beds had to be provided. Generally only minor cases were treated in these wards, those needing major operations or suffering from gynaecological conditions being transferred to the larger establishments of the army. Flinders Naval Hospital, however, with few exceptions, undertook all forms of treatment. Consequently it became necessary to train women in the duties carried out in the male wards by

sick-berth attendants. Suitable recruits were selected and given a course of training equivalent to that given to the men but modified to meet the special conditions.

Some time elapsed before a uniform course could be organised, and at first the type and standard of instruction varied in different centres. Eventually a syllabus was worked out, regulations for advancement in the auxiliary service were drawn up, and towards the end of the war the whole system was working smoothly.

In addition to nursing duties W.R.A.N. sick-berth attendants carried out clerical work, and three or four were employed in the central medical store, Sydney, in duties such as the breaking down and repacking of bulk medicines and dressings. The W.R.A.N. sick-berth attendants played an important role in the naval medical organisation and, in retrospect, it seems regrettable that more encouragement was not given to them to adopt nursing as a career. Although a good deal of discussion took place on this question, nothing definite was decided until the final months of the war. It was then too late. The stumbling block appears to have been the opposing views of nursing bodies in the various States. W.R.A.N. sick-berth attendants were employed at Flinders Naval Hospital; at Balmoral sick-quarters, in the sick-quarters at Townsville, Brisbane, Fremantle and Canberra; and in the recruiting centres at Port Melbourne, Adelaide and Hobart. The total number at the end of the war was 44.

Members of the women's services were also employed as dental attendants, and in one instance as a dental mechanic. Both men and women were trained at Flinders Naval Hospital and Balmoral Depot, and both gave good service. At least one dental attendant was allotted to each dental officer, in addition to others employed in clerical work. Women appeared to be well adapted to this kind of work, but one aspect of their employment was that only male dental attendants could do service at sea and in tropical shore stations, and as time went on it became increasingly difficult to give male sick-berth attendants (D) the necessary periods of shore service.

TABLE SHOWING MEDICAL OFFICERS AND TRAINED PERSONNEL BORNE IN VARIOUS TYPES OF SHIPS

Class	Ship	Medical Personnel Borne		Remarks
		Medical Officers	Sick Berth Staff	
CORVETTES	Colac Cowra Dubbo etc.	—	1 S.B.A.	The 21st and 22nd A.M.S. Flotillas carried one M.O. to each flotilla, in addition to one S.B.A. in each ship

Class	Ship	Medical Personnel Borne		Remarks
		Medical Officers	Sick Berth Staff	
CRUISERS	Australia	3	1 S.B. C.P.O. 1 S.B. P.O. 1 L.S.B.A. 4 S.B.A.	One Dental Officer, One Dental Mechanic, and one S.B.A. (D) were also borne
	Hobart	2	1 S.B. C.P.O. 2 L.S.B.A. 7 S.B.A	One Dental Officer and one S.B.A. (D) were also borne
	Perth	2	1 S.B. P.O. 6 S.B.A.	One Dental Officer and one S.B.A. (D) were also borne
	Shropshire	3	1 S.B. C.P.O. 1 S.B. P.O. 1 L.S.B.A. 3 S.B.A.	One Dental Officer and two S.B.A's (D) were also borne
DESTROYERS	Tribal class	1	1 S.B. P.O. 1 S.B.A.	
	"V" and "W" class and Stuart, "Napier" and "Queensborough" classes	1	1 S.B.A.	
SLOOPS	Swan etc.	1	1 S.B.A.	
FRIGATES	Barcoo etc.	1	1 S.B.A.	
L.S.I.	Westralia	2	1 S.B. P.O. 1 L.S.B.A. 4 S.B.A.	One Dental Officer and one S.B.A. (D) were also borne
	Manoora	2	1 S.B. P.O. 1 L.S.B.A. 6 S.B.A.	
	Kanimbla	2	1 S.B. P.O. 1 L.S.B.A. 4 S.B.A.	One Dental Officer and one S.B.A. (D) were also borne
DEPOT SHIP	Platypus	1	1 S.B. P.O. 1 L.S.B.A. 2 S.B.A.	One Dental Officer and two S.B.A's (D) were also borne

Class	Ship	Medical Personnel Borne: Medical Officers	Medical Personnel Borne: Sick Berth Staff	Remarks
REPAIR and ISSUE	Ping Wo	1	2 S.B.A.	
SHIP FORWARD BASES	Whang Pu	1	1 S.B. P.O. 1 L.S.B.A. 3 S.B.A.	One Dental Officer and two S.B.A's were also borne
VARIOUS AUXILIARIES			1 S.B.A.	
DEPOTS	Cerberus	15	2 Warrant Wardmasters 6 S.B. C.P.O. 11 S.B. P.O. 4 L.S.B.A. 26 S.B.A.	7 Dental Officers, 3 S.B.A's (D), 6 female S.B.A's (D) and 2 D.M's were borne
	Penguin	7	1 Warrant Wardmaster 1 S.B. C.P.O. 5 S.B. P.O. 3 L.S.B.A. 15 S.B.A.	4 Dental Officers, 5 S.B.A's (D) and 4 W.R.A.N.S. were borne
	Rushcutter (including Naval Wing, Naval Recruiting Office and "Canonbury" N.H.)	7	1 Wardmaster Lt 1 Commissioned Wardmaster 2 S.B. C.P.O. 6 S.B. P.O. 8 L.S.B.A. 29 S.B.A.	In addition, 4 W.R.A.N.S. were borne
	Kuttabul	4	1 S.B. C.P.O. 3 S.B. P.O. 4 L.S.B.A. 8 S.B.A.	2 Dental Officers, 2 S.B.A's (D) and 4 W.R.A.N.S. were borne
	Moreton	2	1 S.B. C.P.O. 2 S.B. P.O. 4 L.S.B.A. 7 S.B.A.	2 Dental Officers, 3 female S.B.A's (D) and 3 female S.B.A's were borne.
	Lonsdale	3 1 D.N.M.O. (unmobilised)	1 S.B. C.P.O. 1 S.B. P.O. 3 L.S.B.A. 7 S.B.A.	1 Dental Officer and 1 S.B.A. (D) were also borne
	Huon	1 D.N.M.O. (unmobilised)	1 S.B. P.O. 1 S.B.A.	2 W.R.A.N.S. were also borne

Class	Ship	Medical Personnel Borne		Remarks
		Medical Officers	Sick Berth Staff	
DEPOTS (contd)	Leeuwin	4	1 S.B. C.P.O. 3 S.B. P.O. 4 L.S.B.A. 24 S.B.A.	2 Dental Officers, 2 female S.B.A's (D) and 6 female S.B.A's were borne
	Torrens	1 D.N.M.O. (unmobilised)	1 S.B. P.O. 1 L.S.B.A. 4 S.B.A.	2 female S.B.A's were also borne
	Melville	3	1 S.B. C.P.O. 5 S.B. P.O. 7 L.S.B.A. 21 S.B.A.	2 Dental Officers, 2 S.B.A's (D) 1 female S.B.A. (D) and 1 female S.B.A. were also borne
	Madang	2	1 S.B. C.P.O. 1 S.B. P.O. 2 L.S.B.A. 10 S.B.A.	2 Dental Officers were also borne

CHAPTER 2

EXAMINATION OF RECRUITS

WITHIN 48 hours of the outbreak of war reserve medical officers, who had already been informed of the ships or establishments to which they would be posted, had taken up their war appointments. Drafting officers in the meantime alerted the sick-berth branch, thereby enabling ships to proceed to their war stations with complete medical staffs.

Sixteen medical officers mobilised in Sydney and seven or eight in Melbourne began the medical examination of members of the Naval Reserve. This was a responsible task, and yet demanded speed. During the first week of September 1939 men of the Royal Australian Fleet Reserve and the Royal Naval Fleet Reserve poured into the naval depots of the capital cities, straining their accommodation and facilities to the utmost. Physical examination followed the usual pattern, and was based on the application of more or less empirical tests of constitution, development and general fitness, and the absence of stated defects. Vaccinations and inoculations were also carried out and blood grouping, which later in the war was to become automatic entry procedure, was begun.

PERIODICAL TALLIES OF STRENGTH
OF THE ROYAL AUSTRALIAN NAVY
(including missing and prisoners of war)

December 1938	4,839
July 1939	5,328
December 1939	11,101
December 1940	16,089
December 1941	20,294
December 1942	27,564
December 1943	35,861
December 1944	37,700
15 August 1945	39,468
December 1945	35,877
July 1950	9,431

Recruiting instructions had been drawn up for use in the navy in 1933, and later revised. The physical standards applied to men and, latterly women, entering the navy were in some respects different from those used in recruiting for the army. Two distinctive features of naval standards were that all men entering the navy were volunteers, and that they were selected for particular branches, detailed standards for which were laid down in each case. Men who were later found to be unfit for the work for which they were entered were not drafted to other branches unless willing, and could be discharged if they wished.

A scale of weight and height was laid down, varying with the branch of the Service. In youths a height of 5 feet 2½ inches was acceptable, and a chest measurement of 33 inches. Disqualifying defects were, in general, evidence of constitutional weakness or disease, skin disease unless

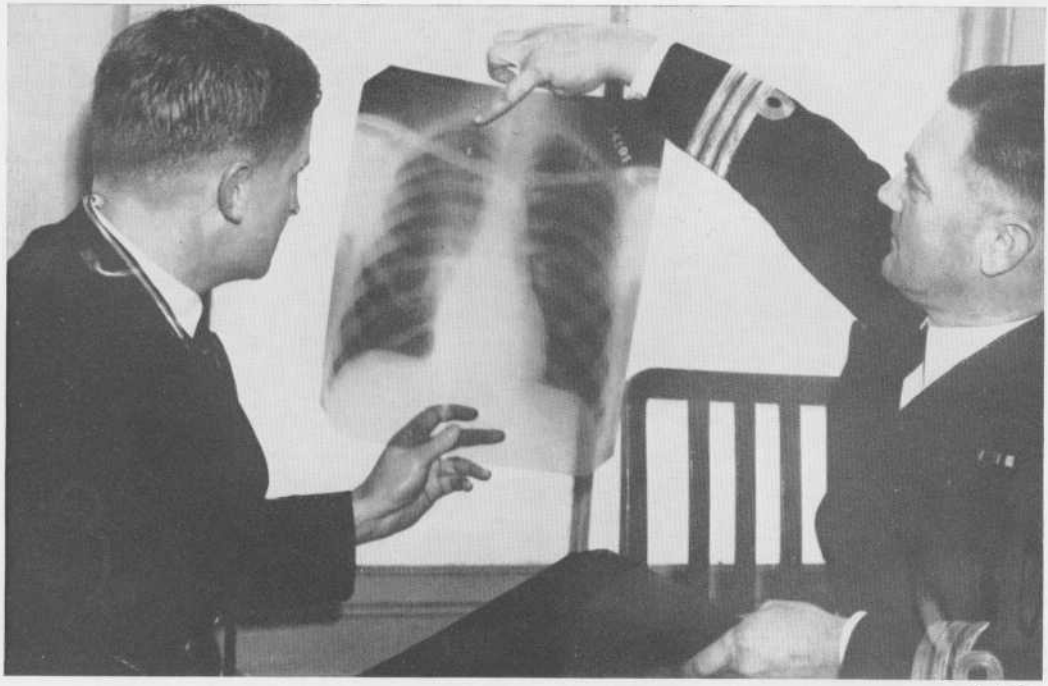


Surgeon Captain W. J. Carr, Director of Naval Medical Services, 1932-1946.



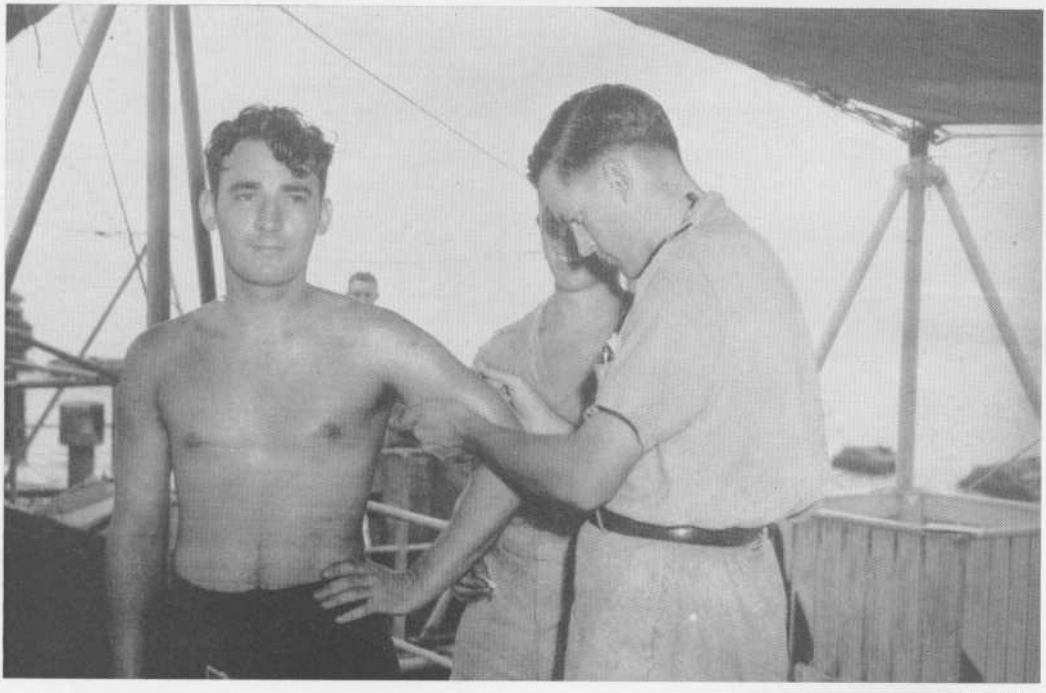
(*R.A.N.*)

The Flinders naval hospital showing (1) the administrative block; (2) the main surgical ward; (3) 'A' Ward (surgical); (4) 'M' Ward (W.R.A.N.S.); (5) 'B' Ward; (6) 'D' Ward; (7) portion of 'C' Ward; (8) the main medical ward; (9) physiotherapy; (10) galley; (11) hospital switchboard; (12) storeroom; (13) covered way; (14) X-ray; (15) laboratory; (16) operating theatre.



(*R.A.N.*)

Surgeon Commander L. Lockwood (right) and Surgeon Lieutenant T. A. McLean discussing X-rays of chest.



(*R.A.N.*)

Surgeon Lieutenant G. L. Grove vaccinating a crew member on board H.M.A.S. *Vendetta* in Darwin Harbour, February 1943.

temporary or trivial (acne did not bring about rejection unless associated with disability), malformation of essential parts, spinal distortion, and certain congenital conditions such as non-descent of the testes. Albuminuria alone was not a cause for rejection.

In addition, the navy demanded special standards of vision: Snellen and Jaeger types were used for tests of visual acuity and the Ishihara and Eldridge-Green lantern tests to detect faulty colour perception. Nasal diseases such as polyps, or defects of hearing and aural infections as detected by an auriscope disqualified. Speech defects also disqualified.

Dentures or other adequate prostheses could be accepted, but some occluding teeth were necessary, the original requirement being six incisors, four premolars and four molars. Pyorrhoea was a bar to service.

These general and special conditions for acceptance applied to artificers, seamen, stokers, sick-berth attendants, cooks, stewards and bandsmen. The application of the same conditions to all these categories was reasonable, as men in the last two, for instance, might have to work very hard during action, and under difficult conditions.

Standards for entry to the Royal Australian Naval College were not specific, but full 6/6 vision was required and account was taken of the fact that officers might have to carry out their customary duties in all climates under hard conditions.

In 1940 some variations of physical standards were introduced. A microfilm examination was made of all recruits and of all personnel to be discharged, as well as of those who had not been so examined on entry. In October a number of additional conditions were laid down regarding fitness for special branches. Dental requirements were relaxed, but the necessity for having opposing incisors and molars was pointed out. The general state of teeth was considered more important than the number. Standards of vision and of colour vision were given for seamen, signallers and wireless telegraphists, mechanics, tradesmen, writers and others. Different standards governed the acceptance of engineers and paymasters.

In 1942 consideration was given to standards of fitness for service in tropical regions. The recruit's medical record was subjected to careful scrutiny, and men who had had a history of alcoholism, neurasthenia, sunstroke, pleurisy, tuberculosis, chronic ear disease, or peptic ulcer were rejected. Fractured skull was also a cause of rejection, but later each case was decided on its merits.

At this time the Repatriation Commission pointed out that the number of pension claims for affections of the ear, nose and throat was growing. Often in such cases there had been a history before enlistment, but without any available record. The importance of excluding recruits with these conditions was stressed to medical officers, and an instruction was given that if a man was accepted with a disability it must be clearly recorded.

When the Women's Royal Australian Naval Service was formed some variation in physical standard was permitted on the side of leniency, as

the strain on women in the navy was less severe than on men. Minimum height was 4 feet 9 inches, and visual acuity of 6/12 in each eye was accepted, even if this standard were attained only by correction. Minor disabilities of the feet were not regarded so seriously, although foot deformities in men were carefully considered. Flat feet were not considered a disability if the arch could be restored.

A few other special cases may be mentioned. Approximate requirements for drivers of motor transport and telegraphists were laid down. Divers and men serving in submarines were selected in conformity with required conditions, X-ray of the chest being an important part of the examination for divers.

During the later years of the war an extension of the detailed British system of tests, known as the Pulhems (later Pulheems) system, was introduced in Canada. No move was made to use this in the Royal Australian Navy. Some caution was felt in the Services for, although the system ensured that careful attention was given to all the necessary parts of the tests, great care and experience were needed in making assessments.

Surgeon Commander W. E. Roberts assembled his experiences of naval recruiting examinations in two interesting articles in the *Medical Journal of Australia* (1st July 1944 and 16th March 1946). He pointed out the desirability of the examiner having had at least a year afloat, during which any physical weaknesses in the crew would be likely to manifest themselves, revealing the errors and omissions in their medical examination. The necessity for following an invariable examination routine was stressed. Commander Roberts found the average height of 1,000 males of 17 to 26 years of age was 5 feet 7½ inches, average chest on expansion 34, and average weight 142 lbs. The corresponding averages for females were 5 feet 3½ inches, 33 inches and 115 lbs. He commented that the Australian male was "not a superman" and often showed evidence of lack of exercise and of faulty nutrition.

The commonest causes of rejection were sub-standard development, visual and dental defects, and structural deformities. In a group of 1,360 recruits examined, 340 were rejected because of defective vision, and 201 for dental defects. Commander Roberts also published an analysis of deformities observed among recruits. Naturally the importance of defects of structure depended on associated defects of function. Most of these rejections were for ratings such as seamen and stokers, though some were for clerical, medical and stores branch personnel.

In another series of 2,090 recruits of 17 to 35 years of age 1,010 were found to be unfit. Of the 1,010, 306 were sub-standard as judged by ordinary requirements, and the remainder by the navy requirements, which were undoubtedly high; 180 of these 306 had definite deformities. In fact, 8.6 per cent of all naval recruits had some form of structural deformity, though not all were significant. Two per cent of the whole had scoliosis, which accounted for 4.1 per cent of those classed unfit. This is not surprising, nor is the finding that 22.7 per cent of all deformities

took the form of scoliosis. It was not considered a bar if only mild and of purely functional type.

Feet also accounted for many rejections: the narrow foot was found to be much more likely to break down than the broad. The commonest varieties of trouble seen were *pes cavus, hallux valgus,* hammer toe, and circulatory disturbances often associated with anomalies of sweat secretion.

The importance of careful selection was well recognised in the navy. Men who broke down on a ship were a severe liability, and more difficult to dispose of than on land, and every effort was made to anticipate preventible casualties of the pre-entry type. Roberts recorded that in one 12-month period 1,218 males were rejected out of 4,769, and 142 females out of 885.

Records of disease and injury in the R.A.N., as in the R.N., were maintained by the medical history sheet and the quarterly medical journal of ships and establishments. Provided these documents were accurately kept, they afforded a reasonably correct record of all cases of death, injury or disease and a true basis for statistics. Unfortunately the medical history sheets, which were loose sheets, had sometimes to be sent by post and, as R.A.N. ships were scattered all over the globe, the sheets were frequently adrift. Actually it is doubtful whether the number of accurate medical history sheets ever exceeded 30 per cent. A suggested remedy for this unfortunate state of affairs was that the sheet should be made a personal issue to each man: possibly it could be attached to his pay documents. If it were a case of "no medical history sheet, no pay", few would be lost no matter how undesirable the entries on them might be from the owner's point of view.

Medical journals, which were the responsibility of the medical officers or, in their absence, the senior sick-berth ratings, were rendered quarterly, and were on the whole conscientiously compiled during the war.

When demobilisation began in 1945 the question arose of claims for disabilities which might be the result of war service, and the medical history sheet and the medical journal provided the two main sources of information for preparing cases for submission to the final survey boards. While the medical history sheet was available to medical officers of the various ships and establishments, the medical journals were retained at Navy Office. Consequently, in order to give as much information as possible on a man's medical record to the boards of survey, all claims had to be prepared at Navy Office, the only place where all information was available. In point of fact, this was an advantage as once a routine was established cases were dealt with in a more rapid and uniform manner than would have been possible had the records been prepared in the man's home port.

During the war many new forms came into being and, although every effort was made to reduce paper-work to a minimum, a considerable amount had to be carried out by the medical officers and sick-berth attendants responsible.

There was one other point relating to medical documents and medical examinations which was of considerable importance. The physical examination of men joining the naval reserve in peace was not particularly strict compared with that of men joining the permanent naval forces, nor was any system of annual medical inspection carried out either in their case or in that of members of the fleet reserve (men who had served their time in the R.N. or the R.A.N. and had then joined the fleet reserve, so making themselves available for call up in the event of war). This meant that either the examination on mobilisation had to be strict and thorough, or that a number of men not really physically fit were passed as fit. In view of the hundreds of men pouring into the depots at the time of mobilisation, a strict examination was out of the question, and a small number of unfit men were passed into the navy. This could have been avoided if a strict examination had been made when the men joined the reserve and not deferred until the mobilisation period, and if an annual inspection had been carried out and a medical history sheet created for each reserve and fleet reserve member.

CHAPTER 3

MEDICAL STORES AND EQUIPMENT

THE focal point of the supply of medical and dental equipment to the Royal Australian Navy was the Central Medical Store, which in 1939 was accommodated on one floor of a building at the Royal Edward Victualling Yard, Pyrmont, New South Wales. The store covered an area of about 8,950 square feet and supplied the needs of about 5,000 men. It was under the control of the Director of Naval Medical Services, and in pre-war days had a staff of six or seven under a Warrant Wardmaster, Mr J. H. Warwick. All stores were bought through the Contracts Board on the authority of the D.N.M.S., whose duty it was to ensure that sufficient stores were always available to meet the needs of the R.A.N. Expenditure was controlled by the extent of the vote, and stores were accounted for by frequent checks held both by internal and external auditors.

The scales of naval medical equipment in force in the years between the wars for ships and establishments of the R.A.N. were based on Royal Navy scales. The various ships and establishments prepared yearly or half-yearly demands in accordance with their respective scales, but could make isolated demands for individual items at any time. All demands were seen by the Director of Naval Medical Services, and where demands were made over the quantities allowed explanations were required.

About 1937 it was realised that the stores position was unsatisfactory. Because of the distances involved and the fact that stores were supplied from one central point only, R.N. scales were not suitable for the R.A.N. Nor was the reserve of stores adequate. In the event of war the reserves available in the Commonwealth of, say, surgical equipment could be rapidly depleted and bulk replacements, for some time at any rate, might be impossible. To meet these difficulties new scales were drawn up on a *per capita* basis and of a considerably more generous nature than previously. Calculations were made, also on a *per capita* basis, on the probable expansion of the R.A.N., and a reserve of stores of all kinds sufficient to meet demands for one year was built up at Sydney. Supplies of some items—dressings, for example—were sufficient for two years.

On the outbreak of war these arrangements were subjected to the test, and they worked very well, no serious shortage of any essential items occurring at the time. All H.M.A. ships in commission were, as a rule, stocked to capacity, and the main difficulties experienced by the store personnel concerned ships in reserve and newly-commissioned ships such as the armed merchant cruisers. However, the difficulties which did arise were overcome, though not without imposing a heavy strain on the stores staff, who worked long hours completing all ships to scale before they sailed for their war stations. Had it not been for the year's reserve of supplies, the difficulties would have been far greater.

A stores sub-depot was established in Western Australia, and complete stores outfits were made available at such places as Brisbane and Darwin for the types of ships likely to call there. Later both Fremantle and Darwin were completely equipped, and could carry on from their own resources. A store was also set up at Milne Bay (this was moved to Madang towards the end of 1944), and another with the Fleet Train of the British Pacific Fleet.

During the period 1939-45 changes in demand were brought about by a number of factors: new fighting techniques were developed, new types of craft produced, and, of most consequence from the medical point of view, warfare was carried into the tropics. As a result, all scales on which stores were issued had to be revised. In the later stages of the war the strength of the various naval forces altered, owing chiefly to the retraction of establishments to the mainland and the dispersal of ships to outlying stations, and the type and amount of stores required again underwent change. When certain scales were no longer in current use they were declared obsolete, so that the organisation fitted aptly to current requirements.

In the course of the war changing conditions also led to the introduction of new types of packs. These were devised and stored so that supplies could be replenished quickly, a necessary condition as ships often had to leave port after only a brief stay. The accompanying table shows the unit packages of medical stores which were adopted.

Title	Description	Remarks
Scale "F"	First aid — expendable items — 10 man — contained in water-proofed wooden box with handle. Size 8" x 10½" x 16".	For use by such as landing craft parties, beach-head parties, small boat duties, etc. Could be expended or abandoned if necessary.
Scale "F1"	First aid—as above, but for larger parties and fixed positions or semi-fixed positions and travelling parties; e.g. Tidepole, coastwatching parties, gun turrets, engine rooms, etc. Size 12" x 10½" x 16".	For use during action stations in enclosed, secured positions, until medical or first aid parties could enter.
Scale "E"	First aid and minor treatments. In waterproofed and fireproofed, steel-bound, wooden pannier, with fall front and removable trays. Hasp and staple and padlock. Size 15" x 14" x 24".	For use in vessels carrying only a coxswain, or for other first aid and minor medical treatments.
Scale "C"	Treatment of minor illnesses and injuries, prophylaxis and anti-malaria. Contained in 3 sectionised panniers of similar construction to scale "E", secured by padlocks.	For use in vessels or remote shore stations where trained member of sick-berth staff was borne but not a medical officer. Certain drugs and apparatus were carried for use if ordered by a visiting medical officer.

Title	Description	Remarks
Scale "Service Afloat"	Medical officer's set of stores, comprising drugs, medicines, surgical, X-ray, dispensing, bacteriological equipment, reference library. Contained in specially designed cupboards and fittings built into the vessel. Provided for all functions, including major surgery in one or more medical stations in the ship.	Allowances based on factors of number of personnel borne, number of medical officers borne, type of duty and length of time before replenishment could be obtained. Quantities of consumable stores were increased according to numbers of personnel borne.
Scale "R.A.N. Air Station"	Scale of stores as for "Service Afloat", but with special additions peculiar to aviation.	Special aviation stores were also borne in aircraft carriers.
Scale "Sick Quarters"	Scale of stores ranging between those for service afloat and base hospital. Might or might not contain certain sections as laboratory, E.N.T., operating theatre, etc., according to local dictates.	Land based and semi-mobile.
Scale "B"	Scale for treatments ordered by the local or visiting medical officer at outlying stations.	At war signal stations, coast-watching stations and Fairmile and coastal patrol boat bases.
Scale "G"	First aid for life-floats. Comprised anti-malarials, fire-making and first aid items. Contained in 4 sealed, ring-tear, water-proof tins and bundle of light splints.	For use in and stowed permanently in the foot grating of all Carley floats and other life-floats. Tins were roll-sealed in order to withstand periods of immersion after the rafts were cut loose into the water. Special packs of food and water, etc., accompanied them, 1 set per 10 men. (Note: the food and water packs were supplied by the Victualling Branch of the R.A.N.)
Scale "H"	First aid for lifeboats. As for Scale "G" but larger, contained in sealed wooden water-proofed box instead of tins.	For use in and stowed permanently in all lifeboats. Special buoyant packs of food and water accompanied them (see note to Scale "G"). One set per 20 men secured to vessel by lanyards.
Aircraft Dinghy Packs	First aid set for rubber dinghies of aircraft. Rubber tape sealed tin.	Permanently attached to and stowed in the dinghy when folded and carried in the aircraft.
Aircrew (Personal) Mark V	First aid for each member of aircrew. Personal issue. Contained in water-proof, rubber-lined and sealed container. (Tear open.)	Carried in special pocket of flying overalls or lifesaving waistcoat (Mae West) of aircrew.

These various unit packages greatly simplified problems of handling supplies, as the number of any given unit required was easily calculated. In general, the units adopted provided for an average requirement of six months, and the principle was followed of not allowing a vessel to sail from its home port on any cruise without having its medical stores fully replenished.

After experiencing some difficulties in obtaining medical supplies in *Sydney* in the Mediterranean, Surgeon Commander H. W. Gault suggested that a full year's issue should be taken by ships leaving Australia for distant stations. Towards the end of the war it was found that the scales were sometimes inadequate because the quantities of various items which were required had not been realised. In one engagement in which ships of the British fleet were attacked by *kamikaze* planes plasma was used in such quantities that, when a second engagement occurred soon afterwards, no plasma remained for the treatment of casualties: a quantity in excess of the supply for three months had been used in one day. The difficulty was increased by the distance of the base from the area of combat.

An action first-aid bag of the haversack type was the standard equipment of the sick-berth rating. It contained: ½ lb cotton wool; ¼ lb picric lint; 6 calico roller bandages; 1 rubber tourniquet; 1 tube "Tannafax"; 4 ounces acriflavine (aqueous) solution 1/1,000; 24 labels; ½ lb plain lint; 6 triangular bandages; 12 safety pins; 8 ounces boric lotion; 1 pair gunboat scissors. In addition, the bags of selected personnel contained a solution of Tr. Opii, m.15 to the ½ ounce, which was replaced in the case of the leading sick-berth rating and the medical officer by a hypodermic syringe and a 1 ounce bottle of morphine sulphate grains 1/6 to m.5.

Action experience proved that some of these items were superfluous and others, which might have been usefully included, were missing. The quantities of lint and cotton wool were sufficient but they would have been easier to handle if, instead of being in rolls, they had been cut into 3 and 4 inch squares respectively, and packed in bundles. This would overcome the problem of getting an exact size and there would be no difficulty if the scissors were borrowed or lost, always a danger in the event of failure of the light. However, scissors, or some such instrument for cutting, were necessary where clothing had to be removed for the exposure of wounds or fractures, and it was desirable that they should be attached by a lanyard to the sling of the first-aid bag. Picric lint was superfluous. Where the lighting was good calico roller bandages could be used, but in a dim light and where there was jostling and overcrowding triangular bandages were the best method of applying dressings. Safety pins were useful. The application of "Tannafax" to second-degree burns tended to relieve pain. Boric lotion was without value. Acriflavine in the aqueous solution was a useful antiseptic and, lacking spirit, could be applied to shocked patients without causing pain. This solution could also be applied indiscriminately to any part of the body without fear of a splash being harmful to any delicate structure, for example, the cornea.

Labels were of the ordinary, commercial type, with a string attached ready for tying to the patient's clothing, preferably in the region of the breast; they were used for noting the quantities of morphia given and the time of its administration, and the time of application and temporary release of a tourniquet. Some organisations attending the injured wrote this information on pieces of paper and stuffed them into the clothing. On one occasion the paper was lost, and the patient suffered agony while a discussion was held as to the time and quantity of the drug administered. The army method of writing the information on the patient's forehead could not be used when burns had been sustained, and most casualties in the navy were due to burns.

Ol ricini, solution of sodium bicarbonate, and splints were not included in the first-aid bag. In a number of engagements much relief of suffering from burn and blast effects of the conjunctiva could have been given if ol ricini had been immediately available, together with a device similar to the Bellamy Gardiner dropper or a cork with a stem applicator for its instillation. In the case of injury from irritant gases affecting the conjunctiva, a solution of sodium bicarbonate would have been useful as a lavage before the ol ricini. Splints had to be improvised, and in emergencies it was extraordinarily difficult to find lengths of wood suitable for the purpose.

The Field Valise of the medical officer proved to be of considerable value. The medical officer of *Voyager* commented on its usefulness in emergencies, in particular when he had to go across to other ships to give assistance.

Dental stores were issued on the basis of one complete surgery per dental officer: prosthetic workshop equipment was allowed where applicable. If ships or establishments were not of a size warranting a full-time dental officer, they relied on the periodical visit of a travelling dental officer with special portable equipment for ordinary dental and prosthetic work.

The packing of medical and dental equipment was important. As in army experience, poor containers often caused waste by breakage and spoiling of the contents; for example, iodine flaked in bottles with metal tops and pharmaceutical firms would not undertake re-sublimation. Plastic tops were not satisfactory; they leaked or broke. Glycerine was a bad leaker and spoiler of other goods. Some equipment returned from the British Pacific Fleet was poorly packed and unsorted.

At the outbreak of war most of the equipment and stores needed immediately by the navy was available, but replacement soon became difficult, and it was evident that the scheme whereby each branch of the defence forces looked after itself would have to be abandoned, and an organisation set up to coordinate the arrangements for obtaining and distributing medical supplies. This was achieved by the establishment of the Medical Equipment Control Committee, on which each Service had its representative. The story of the work of this committee, particularly in the middle and later years of the war, under the chairmanship

of Sir Alan Newton, has been told in other volumes of this history. A description has also been given of the adoption of an inter-Service catalogue of items of equipment and of a wartime pharmacopoeia, embodying all prescriptions permitted by the drugs available, and giving substitutes for those not available or in short supply. Under the system of control of equipment each service forwarded its own demands, budgeting for 12 or 18 months ahead, and the available quantity of each item was divided between the three armed Services and the civil community.

As could be expected in a country which, before the war, had imported a very large proportion of its medical, surgical and dental requirements, shortages occurred from time to time, and it was necessary to ration some articles to avoid depriving the civil population on the one hand or the defence forces on the other. Among the items in short supply were: quinine, bismuth, all forms of paraffin, surgical and hypodermic needles, clinical thermometers, microscopes, cystoscopes and other scientific instruments, all forms of optical glasses, dressings with a cotton base, sheets and towels, X-ray films and X-ray equipment of all kinds including X-ray tubes, dental burrs and false teeth, all items composed of rubber, catgut and other ligatures, and electric torches.

Under the Medical Equipment Control Committee organisation, however, these shortages were overcome by local manufacture, or by the use of substitutes, such as atebrin for quinine and kaolin for bismuth. Numerous firms began the production of surgical instruments, catgut, hypodermic syringes, sulpha drugs and so on and, towards the end of 1945, Australia was practically self-supporting in all essential items. It is difficult to give enough praise to the work of the Medical Equipment Control Committee, and of Sir Alan Newton in particular, in overcoming difficulties which at one time appeared insuperable. Australia was also fortunate in possessing the Commonwealth Serum Laboratories which supplied, in addition to calf lymph and T.A.B., the greater part of the various sera and anti-toxins which were so extensively used in the Services.

Before 1939 the blood transfusion equipment supplied to the R.A.N. consisted of a needle, tube and funnel, through which citrated blood or saline could be given. No universal system of blood grouping had been in force, although later in the war the blood of all men was systematically typed on entry, and a list of suitable donors drawn up. The introduction of the simple Soluvac outfit, which included both a giving and taking set, was an important step forward, and blood banks, organised at first by the Red Cross and later by the army, provided an ample supply of blood serum which was carried by all ships and establishments.

Dried plasma, which was extensively used in the United States Navy, was supplied in the latter years of the war both from American and Australian sources, and this method had its firm adherents; but, speaking generally, wet serum was the stand-by of the naval forces. Two sets of an apparatus devised by Dr Julian Smith and supplied by their designer were very effective for whole blood transfusion. However, their use in-

volved a considerable amount of care and for this reason they were not universally adopted.

No difficulties were experienced in preserving the qualities of the serum supplied. In fact one sample which was forwarded to Alexandria remained on the wharf there for some time and was then returned to Australia apparently none the worse for its long journey and exposure. Serum showing signs of deterioration by the presence of cloudiness was returned to bulk store for reconstitution. The quantities supplied to ships were on a *per capita* basis as follows: aircraft carriers, one pint to five men; other operational ships with a medical officer, one pint to ten men. As mentioned previously, some of the demands made in 1945 by ships of the Royal Navy exposed to *kamikaze* attacks were very large and far exceeded the quantities mentioned above.

Most of the casualties in the sea-air actions of the war consisted of burns and severe shock, and it was always possible that the need would arise to administer morphia to large numbers with the minimum loss of time. For this reason the question of morphia administration was of great importance. Methods used before the war consisted of individual injections by the medical officers or possibly senior sick-berth ratings, using either tablets of morphine sulphate or hydrochloride in bulk solution from rubber-capped bottles. In addition, Wildey's syringe which enabled four or five doses to be given by the one full syringe was available in some ships. Obviously, however, it would be of considerable advantage in a ship, with its numerous isolated compartments, to have a foolproof syringe which would enable anyone, if the need arose, to give a correct dose to himself or to another. Hence the appearance of a self-giving syringe known as "tubunic" ampoule or syrette. Supplies of this article were very difficult to obtain but finally became available. Three types were used in the R.A.N.: the first from the United Kingdom, the second from the United States, and the third made in Australia. They were not extensively used and on the whole they proved a disappointment, by reason of the frequent collapse of the soft metal container or the blockage or breakage of the needle. The American article appeared to be the best.

The stretchers supplied to the R.A.N. were of various types: the ordinary ambulance stretcher, the Neil Robertson, the Hedley, a wire cage variety and the army field stretcher. The Neil Robertson was a heavy stretcher of standard length made of strips of cane bound together with canvas and with restraining bands for the head, chest and legs. By means of a rope threaded through an eye at the head it could be hauled vertically through hatchways and other narrow openings. The Hedley was slightly more rigid and of adjustable length. The wire cage variety consisted of a framework of light metal with a shallow cage of wire-netting; it had a raised portion in its middle lower part which separated the legs, and restraining straps across the cage.

At the outbreak of war the R.A.N. possessed only two ambulances, one at Flinders Naval Depot and one at Sydney. At the end of the war the number had risen to 18, most of the additions being supplied by

the Red Cross. The most suitable type was the four-stretcher variety on an International or other truck chassis. At Darwin the Indian type was used, and in New Guinea a four-wheel drive type was essential. Obviously it was necessary for the navy to possess its own ambulances, and not to be dependent on other Services or on civilian sources.

As the war progressed it became necessary to provide self-contained packs of special equipment to meet special contingencies. These packs contained A.R.P., hygiene, anti-gas and shipwreck equipment, and were issued as special units and not as current stores. The necessity for the issue of A.R.P. equipment arose in 1942 when the entry of Japan into the war brought the threat of aerial attack to Australia. It was forwarded to all shore depots as a self-contained unit, and included all equipment which might be needed after a bombing attack, such as splints, dressings, morphia, triple dye, "Tannafax", and so on. Fortunately its use was never necessary.

With the establishment of naval bases in the New Guinea area and the consequent need for precautions in respect of water, food, mosquitoes and other tropical insects, a special hygiene unit was formed and supplied with hygiene equipment similar to that used by the army, including tools, sprays, oil, water purifying and water-testing outfits and anti-malarial equipment.

It was not until the end of the war that Shipwreck Equipment was ready for distribution. It consisted of a small pack in an air-tight tin, the contents of which are listed in a later chapter.[1]

In anticipation of the arrival of the British Pacific Fleet in Australia, the Department of the Navy arranged for the formation of a Joint Planning Committee, and a Developmental Over-All Plan (D.O.A.P. for short) came into being, towards which all branches of the navy contributed details relating to their own particular section. The medical section of the plan imposed a considerable strain on the resources of the Naval Medical Branch which drew it up. The plan covered hospital accommodation, supply of all necessary equipment afloat and ashore and the provision of medical facilities at airfields and transport. The absence of a medical representative of the Royal Navy, at any rate in the early stages of planning, and the continual fluctuation in total numbers to be catered for, added to difficulties which were already considerable, taking into account that provision had to be made for the care of sick and wounded and for the replacement of stores for a large fleet which would be working in an unhealthy climate thousands of miles away from its main base.

The R.A.N. Medical Service agreed to provide all requirements with the exception of certain items unprocurable in Australia, a list of which had been forwarded to the Admiralty. This agreement was also subject to the provisions:

(*a*) That six months' notice of arrival should be given by the Admiralty.
(*b*) That all R.N. ships should arrive fully stored, and
(*c*) That the R.N. should accept the R.A.N's schedule of stores.

[1] See p. 95.

The R.A.N. Medical Service also stipulated that a Bulk Store to be established should be under its own administration. A suitable store was obtained by the requisitioning of Woolworths' building in Glebe, Sydney. This provided about 79,000 square feet of floor space. Some alterations were necessary to provide accommodation for a staff of 110 under Commissioned Wardmaster Warwick, who was assisted by an R.N. pharmacist acting as liaison officer. The staff included about six members of the R.A.N. and three members of the W.R.A.N.S., the remainder being civilians or ex-members of the navy. The building was divided into receiving and dispatch sections, each with its own loading bay into which lorries could drive direct, a packing section, and a section where bulk stores could be broken down into fresh packs.

The volume of the work carried out at the store can be gauged from the fact that in one month alone 800 separate requisitions, some of them containing hundreds of items, were efficiently dealt with and dispatched. The greater part of the stores was either transferred from surplus army stock or obtained direct from commercial houses. The administrative side of the supply organisation was controlled by Surgeon Commander E. A. Rowlands from Navy Office, Melbourne.

Stores from the United Kingdom requested in September 1944 did not arrive until near the end of the war, and some difficulty was experienced in obtaining items, such as X-ray equipment, which were in short supply in Australia. This delay was understandable in view of the strain under which England had laboured during the war. The R.A.N. catalogue of equipment appeared to be generally acceptable to the R.N., although complaints were made concerning the blood transfusion equipment and some pathological items. Speaking generally, however, the demands of the R.N. were met satisfactorily.

The alternative methods considered for supplying equipment to the ships of the British Pacific Fleet in forward areas were the establishment of a supply depot on shore as close as possible to the fighting area, or the provision of supply ships to accompany the fleet. The latter was the method recommended and accepted. Replacement of drugs, dressings and other requirements were packed in units of an amount calculated to supply x men for y days. These were known as "X" units. Such units were placed in six different supply ships, and towards the end of the war consideration was given to fitting out a medical store ship. This distribution was made on the principle of not putting all one's eggs in the same basket, and appeared to be the best method of ensuring that supply would always be on hand if needed. In addition, of course, the battleships, aircraft carriers and other larger ships acted as feeders to the destroyers and similar ships. The scheme involved having a large reserve of stores scattered over the ocean, but this was a small price to pay for the security it gave.

CHAPTER 4

LIVING CONDITIONS IN SHIPS

THE growth of the Royal Australian Navy during the war was due not only to an increase in the number of ships commissioned: the complements of existing ships also expanded. The extent of this expansion may be best appreciated by comparing the figures for different periods, as shown in the accompanying table, which is only illustrative, and does not include all ships or establishments of the R.A.N.

COMPARATIVE COMPLEMENTS OF R.A.N. SHIPS AND ESTABLISHMENTS

(indicating changes during wartime)

H.M.A. Ships	Complement	Date
Heavy cruisers:		
Australia (10,000 tons)	725	31/12/39
,,	1,078	31/12/44
Canberra (10,000 tons)	802	31/12/39
,,	817	8/8/42
Light cruisers:		
Adelaide (5,100 tons)	450	31/3/40
,,	530	31/12/43
Hobart (6,980 tons)	614	30/9/39
,,	950	30/6/45
Destroyers:		
Arunta (1,800 tons)	230	30/6/42
,,	334	30/6/45
Warramunga (1,800 tons)	259	31/12/42
,,	320	30/6/45
Norman (1,690 tons)	240	31/12/40
,,	304	30/6/45
Nizam (1,690 tons)	225	31/3/41
,,	260	30/6/45
Stuart (1,530 tons)	160	31/12/40
,,	209	31/12/43
Vendetta (1,090 tons)	145	31/12/40
,,	188	30/9/44
Minesweepers:		
Toowoomba (650 tons)	68	30/6/42
,,	93	30/6/45
Townsville (650 tons)	75	30/6/42
,,	90	30/6/45
Geelong (650 tons)	65	30/6/42
,,	86	30/9/44
Ballarat (650 tons)	65	30/6/42
,,	100	30/6/45
Bathurst (733 tons)	70	30/6/42
,,	90	30/9/44
Benalla (650 tons)	80	30/6/43
,,	100	30/6/45
Bendigo (733 tons)	70	30/6/42
,,	86	31/3/45

H.M.A. Ships	Complement	Date
Sloops:		
Warrego (1,060 tons)	134	30/9/40
,,	185	30/6/44
Yarra (1,060 tons)	112	30/9/39
,,	145	31/12/41
Swan (1,060 tons)	120	31/12/39
,,	178	9/2/45
Landing Ships Infantry:		
Kanimbla (10,985 tons)	290	31/3/40
,,	330	30/6/45
Westralia (8,108 tons)	292	31/3/40
,,	330	30/6/45
Base Staff, Port Moresby:		
Basilisk	157	30/9/42
,,	580	30/6/43
,,	142	31/3/45
Base Staff, Townsville:		
Magnetic	180	30/9/42
,,	1,105	10/7/44
,,	870	30/6/45
Base Staff, Milne Bay:		
Ladava	80	30/6/43
,,	1,750	31/12/43
,,	416	30/6/45
Base Staff, Sydney:		
Penguin	1,938	30/9/41
,,	1,500	30/9/42
,,	952	30/9/43
,,	1,430	30/9/44
Flinders Naval Depot:		
Cerberus	1,351	30/9/39
,,	2,135	30/9/40
,,	3,339	30/9/41
,,	3,478	30/9/42
,,	4,616	30/9/43
,,	3,738	30/9/44

It should be noted that landing ships infantry (L.S.I.) show a considerable increase in the numbers of men carried; this was a result of a change of function of these ships, which, from being armed merchant cruisers, became, in 1943, landing ships for infantry in combined operations.

The expansion of ships' complements and the consequent strain on space within each ship were due to basic changes in the conditions of naval warfare—to the closer interworking of the navy and the air force, the increase in speed and power, and the great extension of mechanical methods, including methods of damage-control and of detecting the presence of enemy vessels. Space which had previously been used for diversion or for educational purposes or even for rest, was taken up by quantities of machinery and technical equipment and by additional men to operate it.

Questions of space arose with great force in small ships. For example, in the old destroyer *Vendetta* 125 ratings were carried nominally, but

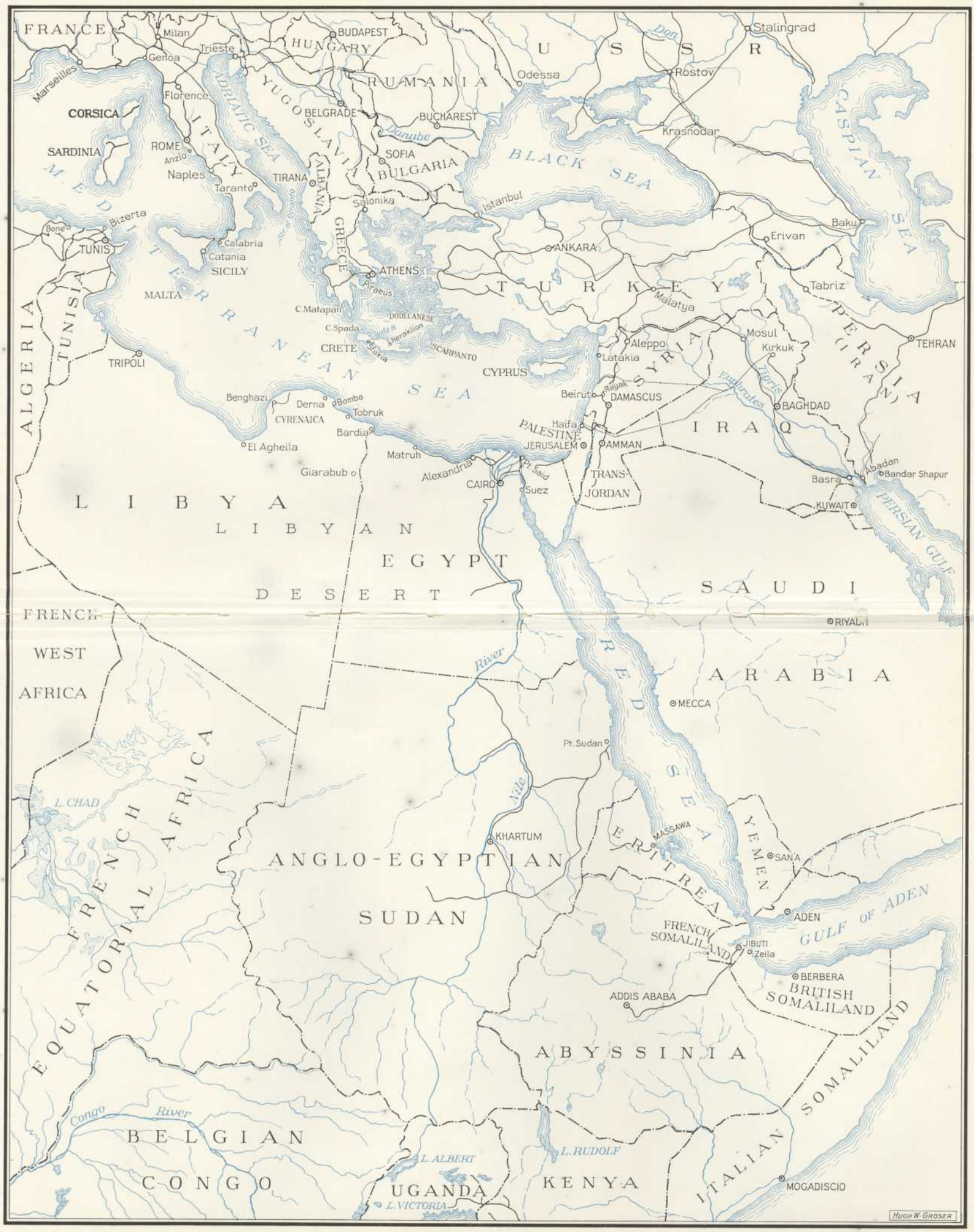
this number was increased to 188, the additional men being wanted to operate special equipment for which the ship was not designed. The unavoidable crowding of the mess decks was heightened by the presence forward of the capstan engine. Sufficient water for all purposes could not be stored, and encroachments were made on the space for bathing until the officers had no room for anything but a wash: the men, who could at least stand on a tiled deck and throw a bucket of water over themselves after soaping, were better off. Sanitary arrangements were also inadequate; there were too few pans and in heavy weather, with the system of horizontal flushing, the contents of the flushed pan were often thrown back by an uprush of sea through the pipe.

During the winter of 1940 the same conditions largely prevailed in *Stuart* and *Vampire*. Surgeon Lieutenant C. P. C. Reilly of *Vampire* reported that in weather which was not absolutely smooth bedding and clothing became wet; men could not find a dry spot to sling their hammocks and so did not obtain enough sleep. The result was a falling off in efficiency and an unhealthy state of mind.

It was not only in small ships that the addition of equipment and machinery and the resulting increase in ships' complements interfered with the normal accommodation. In *Australia* diesel dynamos were fitted in the midshipman's flat, making what was formerly ample sleeping and study accommodation practically uninhabitable.

Climate was a variable factor in ships at sea, and in naval ships in particular it was impossible to avoid subjecting the crews to discomfort caused by the extremes of cold and heat. Cold was a serious problem, even producing local circulatory disturbances in a disabling degree, as in the case of frost-bite. Equally serious were the respiratory diseases which occurred with frequency during bitter winter weather when the hatches were closed down, hindering the circulation of pure air.

The crews of Australian ships were more familiar, however, with the climatic trials of tropical zones. In the Red Sea, Arabian Sea, the Persian Gulf and the Pacific Ocean they served under very trying conditions. Medical officers have commented frequently on the temperatures experienced. During the Arabian hot season of 1940 the climate in and around the Red Sea was up to its usual standard. Surgeon Lieut-Commander H. G. Wells in *Hobart* noted the temperature to be consistently high night and day, with a maximum of 94°F. and a minimum of 81°F. The high accompanying humidity, 69 per cent by day and 85 by night, increased the oppressive nature of the weather and for 51 days at sea the scuttles were closed and deadlights down, imposing a severe strain on all hands. It was even recorded that one of the "fresh" eggs in the wardroom pantry incubated, though the chicken survived the conditions for only ten days. In September 1940 *Hobart* experienced her record temperatures at Berbera, where the dry-bulb readings reached 100°F. in the wardroom flat, and on one occasion the wet-bulb reading even exceeded 94°F. The engine-room readings reached 130°F. dry, but wet-bulb figures were never over 95°F.



The Middle East.

At a later date further observations were carried out in *Hobart* by Surgeon Commander L. Lockwood under similar living conditions with high temperatures and high humidity associated with the monsoonal season. At the end of November 1942 records were made of wet-bulb and dry-bulb temperature readings using the whirling psychrometer. The factors influencing temperature, such as the position of the sun, were fairly constant and represented the average figures for the quarter. The wet-bulb readings did not exceed 80°F., except in the galley, where it was 90°F. The dry-bulb here was 105°, but elsewhere was around the figure of 93° to 94°F. The highest temperature recorded was 129°F. in the engine-room.

Conditions were particularly trying when crews were at action stations. For instance, Surgeon Lieut-Commander S. E. L. Stening found *Perth* excellent in temperate climates but in tropical regions heat exhaustion could be readily produced when the crew were at first or second degree of readiness for long periods. He described the heat and humidity with hatches closed and all fans stopped as "terrible". Men from the medical party showed extreme degrees of exhaustion, even within half an hour, and had to be sent on deck in turn to recover. When sufficient power was available to allow the air-conditioning plant in the sick bay to function the improvement in conditions there was striking.

In *Adelaide,* an older ship, observation showed the temperatures high at some points, particularly the engine-room and staff quarters. The average humidity, however, was reasonable for the dry-bulb readings. It is of interest that installation of the radar cabinet caused ventilation problems. After operators had complained of headaches and eye strain it was found that the air flowing in was vitiated by fumes from the galley and that escape of the impure air was not adequately provided for.

Inefficient ventilation was noted in a number of other ships—in *Stuart, Vampire, Vendetta, Napier* and *Nizam.* Generally speaking, the destroyers had been designed for service in cold climates. Surgeon Lieutenant H. B. Holmes of *Nizam* remarked that while the ship had many heating devices, cooling was neglected, except for the punkah-louvre system of forcing air into the mess decks. Little attempt had been made to provide any escape for the fetid air and, with a blacked-out ship, the atmosphere between decks soon became foul. When *Stuart* and *Vendetta* were refitted a system of forced ventilation was installed fore and aft, and this led to an inestimable improvement in conditions. Surgeon Lieut-Commander D. K. McKenzie of *Shropshire* was of the opinion that that ship needed more exhaust ventilation while in the tropics and Surgeon Lieutenant W. H. Milroy, who examined samples of air taken from the C.P.O's mess of *Swan* at dawn, with hatches still closed, found that the carbon dioxide content was five times the normal amount. In *Manoora,* the first Australian combined operations ship, increased facilities for ventilation were provided since, in addition to the crew of 240 men, more than 1,000 army personnel might also be carried. Even so, the medical officer, Surgeon

Lieutenant S. A. C. Watson, considered that the cramped living quarters would be intolerable in the tropics.

In some of the newer small ships good ventilation was provided. In *Diamantina,* for example, a frigate commissioned in 1945, punkah-louvres supplied ample air by forced draught, and exhaust fans extracted contaminated air. Forced draught from the engine-room also helped greatly in maintaining ventilation in the ship. The minesweeper *Pirie* had a similar ventilation system, subject to the limitation that blackouts and closing the ventilation hatches stopped ingress of fresh air. Air flow was also deficient in the store and other related areas, owing to hot air emanating from the engine-room.

Medical officers of the R.A.N. and the R.N. collected much useful information on the so-called "tropical fatigue", which caused lethargy, loss of weight, slowing of mental and physical activity, and disorders of sleep, of digestion and of the skin. In this state not only fatigue is involved in heat, but also undue sweating, factors which concern the metabolism of salt. The necessity of taking enough salt in the diet when working under tropical conditions was thoroughly explored by medical officers, as is described in a later chapter.

In 1941 Surgeon Commander C. A. Downward in *Canberra,* which had been in a tropical zone for some time during which it was impossible to obtain adequate quantities of fresh fruit, vegetables or eggs, noted that numbers of men had become debilitated and weak. Although still on duty, these men were victualled with those in the sick bay, for whom the cooking was done by sick-berth attendants who had received special instruction in the preparation of nutritious and appetising food. This treatment proved satisfactory for those losing strength and weight, and cast some light on the dietetic aspect of tropical fatigue.

During the first part of 1941 the general health of the ship's company of *Yarra* was below standard. Many ratings lost weight and suffered from indolent ulcers on the site of insect bites. Surgeon Lieutenant W. J. McLaren-Robinson considered that four factors were responsible: heat, diet, lack of leave and malaria. *Yarra* was stationed in the Shatt-el-Arab River at Basra, where the climate was extremely hot, with a shade temperature of from 105° to 110°F. Cabins and sick bay averaged a temperature of 90°F., which fell only slightly at night. The prevailing wind was a dry, hot northerly, changing to a hot, humid southerly in July. Diet was restricted, green vegetables were practically unobtainable, and there was no fruit, except very small amounts in tins. Leave was severely curtailed and gave no opportunity for exercise, swimming being forbidden because of the presence of Schistosome infection. Anopheline mosquitoes abounded, and 50 cases of malaria were seen by McLaren-Robinson in two months.

Investigations carried out in 1945 by Surgeon Commander F. P. Ellis, R.N., working with the Medical Research Council's Tropical Research Unit in Singapore, confirmed observations made by Australian naval medical officers on the effects of prolonged working in an unduly hot

environment. Recommendations on this subject had been made by the R.N. Personnel Research Committee in the previous year. Subsequently, in 1952, Sir Frederic Bartlett, Professor of Experimental Psychology at Cambridge, and other workers in this field discussed the topic and pointed out that little could be done in immediate relief of the discomforts often associated with fatigue. Enforced rest and meeting the situation "with a certain dogged fortitude", helped to defeat apparent exhaustion by the curious phenomenon of the "second wind". In closed communities like ships the symptoms could readily be recognised, but were not necessarily simple to relieve.

In a more recent discussion Ellis has expanded somewhat on the social and domestic factors in the causation of tropical fatigue, apart from salt deficiency, and summarises the various aetiological types of hot climate fatigue. He has also dealt with the requirements of salt and water in men working in tropical heat.[1]

It will be seen that personal experiment and inquiry in this important subject were of great value, and have disseminated knowledge among naval officers and ratings. Preventive measures where possible have been made widely known, and the indications for the future have been suggested. In this regard it would seem that there is a need for more scientific work on ventilation in ships, and for the wider employment of an air-conditioning system. The forces of nature call for strong opposition, particularly during war waged in tropical zones by land and sea, and the ability and ingenuity of engineers are required to bring science to bear on the problem and not mere improvisation.

Food and Nutrition. No actual malnutrition occurred among naval personnel except among those who became prisoners of war. Minor manifestations attributed to diet included pyodermia and other skin lesions, though food was probably only one of the factors responsible. More convincing was the occasional occurrence of oral lesions in men whose diet was poorly balanced with an assumed lack of riboflavin. Observations made on the state of the blood of men serving in tropical areas where food deficiencies might have been expected to lead to anaemia yielded negative results. Serial blood counts were carried out in *Moresby* while that ship was in a tropical zone. A representative cross-section of the ship's company was taken, but no significant variations from normal standards were found either in the white or red corpuscles. These investigations were repeated for several months with the same results. In this connection it should be noted that men who were in good health on embarkation very seldom developed extraneous organic disease, and their general health usually remained satisfactory.

Surgeon Lieutenant-Commander Stening carried out an investigation of victualling in the general mess in *Perth.* He estimated the percentage caloric value of each article of food and computed the total calories issued daily by the paymaster. From this the total calories available to each man was calculated with the vitamin value. This study covered the whole

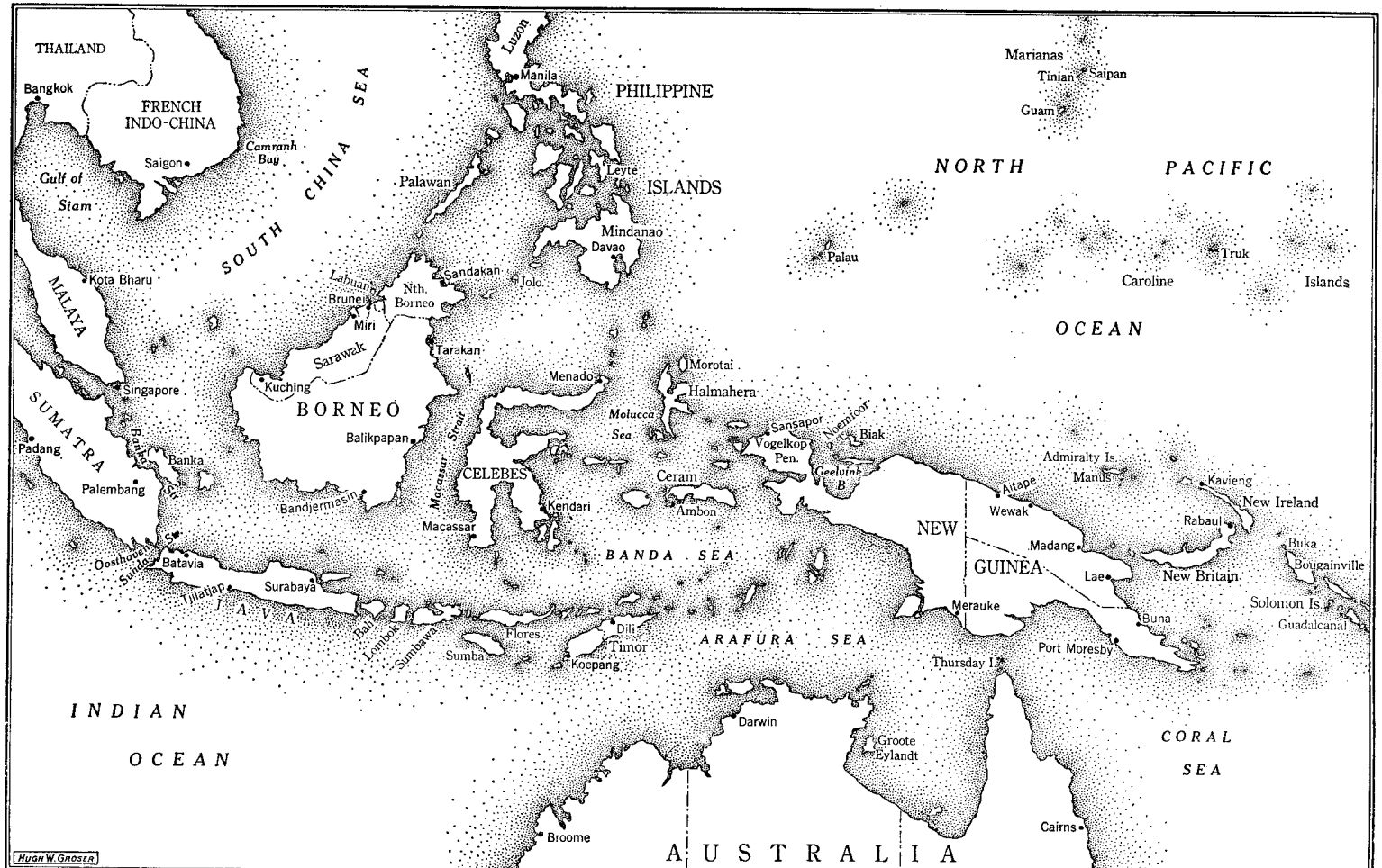
[1] *British Medical Journal,* 4 Sept 1954.

of December 1941, and although the details were lost when the ship was sunk, it was reckoned that 5,400 calories were available per head per day, of which 5,000 calories were consumed. The vitamin content was satisfactory, but its distribution could have been bettered. The caloric value of this dietary was twice that supplied to the German ship *Bismarck,* and 50 per cent more than the army ration. Stening recommended that paymasters be instructed in the caloric and vitamin values of food.

A balanced diet could more readily be supplied if there was full collaboration between the victualling officer and the medical officer. Surgeon Lieutenant C. K. Churches in *Warrego* found that the repayment system of messing helped in supplying a good ration, and Lieut-Commander H. J. Weston in *Deloraine* attributed the excellent state of the men's health in 1943 to this system. In view, however, of the continued rising prices of green vegetables and fruit, which had no fixed issuing price, the full repayment allowance of 1s 9d per day was not adequate. Mess excess over and above repayment rose as high as 6s per man per month, which was a not-inconsiderable burden for able and ordinary seamen. Supervision was also necessary, for in general it was found that ratings were unable to plan a balanced diet. If left to themselves they allowed green vegetables to rot before purchasing them, and some even bought tinned vegetables when green ones were available.

The diet in ships, of course, varied with prevailing conditions. In 1941 Surgeon Lieut-Commander J. K. Maddox reported that the company of *Westralia* was without fresh food in the tropics for three months. When the ship put in at Darwin supplies available there were not well balanced: the only vegetables obtainable were potatoes; meat was of low quality and tinned fruit was scarce. Tests of 39 men showed that only five had a sufficient reserve of ascorbic acid, but the position was then eased by fresh supplies from Cairns. Such difficulties could not always be avoided, and the differences in diet were apparent when a ship's assignment permitted victualling under more favourable conditions. For example, *Hobart* was able to maintain a high dietetic standard in the Pacific area during 1942. "Marmite", which assured ample supplies of vitamin *B*, and fresh vegetables and milk were issued to the ship's company through the general mess whenever possible, and tomato juice was available to the sick bay. *Warrego* experienced a sharp contrast in the standard of diet during one quarter of 1941. At first the ship was frequently in port and had opportunities to maintain fresh supplies but towards the end of the period when operating from advanced bases the diet was restricted. It consisted mostly of meat and potatoes, and the medical officer, Surgeon Lieutenant Churches, suspecting vitamin *B* deficiency, endeavoured to correct it by securing supplies of "Marmite"; the only source of vitamin *C* was a daily issue of lime juice, the ascorbic acid content of which was not known; and the intake of calcium was low, since powdered milk and cheese could be issued only in small quantities.

Deterioration was an important factor in food deficiency. Meat transferred in barges sometimes arrived damaged, and green vegetables from



Far Eastern Theatre

storage refrigerators needed prompt handling before withering took place with consequent loss of vitamins. In June 1944 there was an outbreak of food poisoning in *Warramunga* while that ship was proceeding to the naval bombardment of Noemfoor. Numbers of ratings appeared in the sick bay with nausea and headache, which were followed by vomiting, nervous prostration and collapse. The medical officer, Surgeon Lieutenant J. H. Begg, diagnosed the trouble as solanin poisoning, and traced it to potatoes which had been brought on board one month previously. Most of them had been sprouting and, although they appeared bad, all were not thrown out. This was one of the disadvantages of the repayment system of messing—that individuals messing on repayment were reluctant to discard food of doubtful freshness for fear of incurring large mess debts.

Variability in rations was observed throughout the war to some extent. The Darwin area continued to be a problem both to calling ships and fixed establishments. Fresh meat and butter were variable in supply, and even at the naval hospital the diet was at times deficient in vitamins. In 1943, however, local vegetable gardens and those at Adelaide River began to produce, and next year gardens were established at the hospital and the Boom sick-bay. The hospital diet, aided by Red Cross supplements and local purchase, was then most satisfactory, but constant efforts were necessary to keep it at this level.

Water. In land establishments water-supplies for naval personnel were usually obtained through the army, and necessary information concerning water and hygiene was given by army hygiene officers. For example, warnings of the need for chlorination of water in certain areas, such as water-points in the Moresby area, were passed on to the navy by the army hygiene organisation. This cooperation was important when ships took on supplies of water. Ships which carried variable numbers of men like the troop carriers and landing ships were faced with special difficulties. During 1944 the commanding officer of *Manoora* had to impose severe restrictions on the water consumption of the ship's company. When 1,100 troops were embarked the restrictions became even more stringent, and at a muster of the crew 142 cases of skin infection were discovered. Surgeon Commander R. F. Matters, the medical officer, warned that the results of the water restriction policy might be serious, but there was no relaxation, even after a body of American troops had been landed. By this time 150 ratings had been excused duty, and restrictions were then relaxed for 24 hours.

Such problems occurred not unnaturally in ships originally designed for passenger traffic between close ports of call. It was, of course, equally natural that medical officers should represent the case for augmentation of water-supplies and relaxation of restrictions to a point where measures of hygiene could be properly applied.

Laundering of clothing at sea constituted a difficult problem, which became more acute as the size of a ship's company increased or when troops were carried, as in a landing ship, or when the demands of the

medical services were suddenly increased by casualties caused in action. Destroyers, for example, were considerably affected by an increase in the numbers on board; *Vendetta* among other such ships found the supply of water was sufficient for other purposes, but there was not enough for laundering. *Nizam* in 1945 was able to keep the standard of personal and ship's hygiene high, but opportunities for swimming were then also available. The allowance of water for domestic purposes was eight tons a day, which was sufficient. On other small ships, such as frigates, adequate fresh water for laundry purposes could be assured only by keeping distilled supplies in ballast tanks when opportunities for replenishment on shore were limited.

Laundering methods were often time-honoured but primitive and comparison with facilities on ships of the United States Navy convinced Australian officers of the value of "new-fangled" ideas. Surgeon Lieutenant Watson of *Arunta* remarked in September 1944:

> The days of the haphazard boiling of overalls *et cetera* on the galley fire and washing in a bucket on the upper deck must surely pass. This service was looked on as an emergency measure for destroyers which could get satisfactory laundry service every fortnight or three weeks in port. It is too crude and inadequate for satisfactory use over many hot months in uninhabited island anchorages. Two days ago an American destroyer laundered the sick bay linen, soiled from blood and burns, and returned it dry within two hours! They had put it up in bundles and autoclaved it also.

Even in shore establishments laundry facilities were sometimes limited: in *Assault* they were described by medical officers as "primitive" and sanitation was also open to criticism.

CHAPTER 5

ACCOMMODATION OF SICK AND WOUNDED

ALL ships of the Royal Australian Navy, except small craft—motor launches, those used for shore defence, and the like—possessed sick bays, either built-in or improvised, ranging in size from the comparatively large ones in cruisers of the *Canberra* class to the small two-bed type in destroyers and frigates. Generally the space allotted was inadequate, especially when compared with that in ships of the United States Navy. With the increase in the size of ships' companies already referred to, calls on the sick bay were automatically increased, and if infectious diseases broke out making it necessary to attain isolation, the congestion was likely to become acute.

Even in the relatively spacious sick bays of cruisers isolation and privacy had to be denied to the sick and dying. Surgeon Commander J. M. Flattery described the sick bay in *Australia* one morning in 1942 when "one bed was occupied by a rating with measles, screened off by sheets, and another by a rating in a dying condition. At one end of the beds about 40 ratings were lined up to see the medical officer."

In corvettes the sick bay was of necessity small. In *Toowoomba* it was added after the need became urgent, and although a distinct asset and in a convenient location, it was only 6 feet square, and contained a bunk 6 feet by 2 feet, with the medical cabinet and sterilising and other electrical equipment taking up the remaining space.

In the "V" and "W" class destroyers there was originally no sick bay. In *Vendetta* the cabin occupied by the coxswain beneath the bridge was used for the purpose, and all patients needing hospital treatment or isolation had to be transferred to a shore hospital. Even the provision of space for the carriage of antisera and vaccines was a problem; these had to be kept in the ship's refrigerator, used for bulk storage of meat, and thus were often inaccessible.

In the Tribal-class destroyers the area allotted for the sick bay was more generous. In *Arunta* up to eleven cot patients might be taken in an emergency, some of them on the deck, but only for a very short time. Normally, it was fitted with two bunks, one of which was removed and the other covered with 5-ply, making a useful couch for examination or minor procedures. Its situation, however, was poor, being over the gear room. The proximity of steam pipes made it very hot, and rather than endure it sick ratings preferred to contend with the weather in their hammocks on the flag deck, while the noise and vibration made it difficult for the medical officer to make stethoscopic examinations or to give injections. Surgery was carried out only with reluctance, and post-operative treatment was likely to impose a strain on non-medical members of the ship's company. In *Warramunga* a seaman operated on for acute appendicitis had to be nursed in the captain's cabin.

In converted merchant ships the sick bay was usually spacious, though its position was not always ideal. Surgeon Lieut-Commander C. P. C. Reilly recorded that, although the sick bay in *Manoora* could accommodate 18 patients, it was almost alongside the engine-room and on "D" deck. Artificial light was necessary while at sea and, despite forced ventilation, it was airless and hot. The greater safety of this deck over an upper deck was doubtful, as the bay was perforce cleared on several occasions while the ship was in submarine areas.

When the armed merchant cruisers—*Manoora, Westralia* and *Kanimbla* —were converted to L.S.I. new problems arose for the naval medical service. Surgeon Commander R. F. Matters wrote about the conversion of *Manoora*:

> The traditional methods of naval warfare existed in the Royal Australian Navy until 1943 when hitherto unknown naval tactics were to be adopted by the R.A.N. and the untried methods also called upon the medical branch to give up the older naval surgical methods of a barrel of tar and a grain of calomel. It was pronounced in the highest octave of hush that two Commando Ships were to be commissioned and the "two" between inaudible whispers became "three".
>
> The two ships first to go through this metamorphosis were *Westralia* and *Manoora.* These two ships had enjoyed a luxury-liner war in all their panoply as passenger ships, but flying the White Ensign. The change from the yellow funnels to the "Grey Funnel Line" took place at Garden Island, where the ships were stripped of the woodwork, panelling, etc., and were left as empty steel hulls with steel decks, steel ladders, etc. Festooned around these ships were a number of invasion barges or L.C.P's or L.C.V.P's and the ships were so divided as to give for'ard, midships and after parts for "action stations".
>
> With this entirely new outlook on naval warfare it became necessary for a changed outlook for the medical branch. Consequently the smallish sick bays had in addition the space of several cabins cleared for an operating theatre and there were a large number of slung cots or special hammocks capable of being able to be slung from the deck heads of the mess decks. Accommodation was made also for an X-ray room and its appurtenances.
>
> In addition were three emergency stations on the main deck, one for'ard, one midships and one aft for dressing stations and capable of rapid conversion into minor theatres should the rest of the ship become untenable owing to fire or other damage.
>
> Instructions were given to provide for all medical and surgical possibilities, as the commando outcome could not be predicted. Arrangements were made for fifty Thomas splints to be issued to each of the three ships which ultimately formed the squadron, *viz, Manoora, Kanimbla* and *Westralia,* as it was considered many cases of fractured legs might ensue.
>
> The Girl Guides Thrift Movement of Adelaide very generously presented artery forceps, towel clips, scalpels and a pump for each ship's operating theatre to operate a sucking apparatus. Incidentally they had generously given £1,200 to provide a most excellent naval ambulance for Adelaide.
>
> In the early days of these ships the base was in Port Stephens; it was called H.M.A.S. *Assault.* Here we did preliminary training and we invented various forms of platforms, splints and stretchers for bringing the wounded on board. Many mock rescues were made. . . . Later *Manoora* returned to Port Phillip Bay where mock battles and landings took place off Dromana. U.S. Marines were our first Commando group and at Dromana, Victoria, the huge waves caused many casualties including men being crushed between the ship and the landing barge.
>
> The method of disembarking from the L.S.I. into the L.C.V.P. was by means of a huge scrambling net hung on the side of the ship. Down this the soldiers

had to climb and await the barge as it rose and fell on the huge waves and occasionally was washed suddenly against the ship's side trapping some unwary soldier. All casualties were dealt with immediately in hospital or sick bay.

The number of medical personnel carried in each ship varied according to its size. Large aircraft carriers, of which the R.A.N. had none in the war, were theoretically allowed four medical officers; a battleship, or cruiser with a complement of over 1,000 men, carried three; smaller cruisers two; sloops one, and destroyers, which had to subordinate crew space to engine power and armament, none. These establishments, however, were fairly elastic and might be varied according to the nature of the service, climate or other factors, as they were in 1940 when a medical officer was appointed to each of the five Australian destroyers in the Mediterranean, because of the intensity of operations in that sea. In the case of corvettes and ships of similar size and power there was usually one medical officer to each flotilla. In the 20th Minesweeping Flotilla, comprising two sloops and several auxiliary sweepers and corvettes, which operated on the Australia Station in the first six months of 1941, Surgeon Lieut-Commander N. W. G. MacIntosh was the only medical officer. These craft were sometimes together, at others dispersed, and regular visits to each by the flotilla medical officer were often impossible because of heavy weather or the prior claims of sweeping operations in progress. In these circumstances, the sloop *Swan* acted to some extent as a hospital ship, and on one occasion was holding seven patients from various ships. As the sick bay contained only two cots and it was necessary to keep some space for emergencies, patients were put ashore to make room.

The larger ships possessed all facilities for carrying out surgical operations. In smaller ships conditions restricted the scope of work, and conservative treatment was preferable. In fact, except in emergencies, it was found wise not to attempt surgery as the risks of sepsis were too great and facilities too limited for deliberate work. Even in larger ships only emergency operations were, as a rule, performed at sea, serious cases being landed as opportunity offered, for it was obviously advisable to keep sick bays as empty as possible against the possibility of action.

The medical organisation for action varied with different ships and different medical officers, but it was governed by two main principles—

(*a*) Personnel and stores should be as widely distributed and each action station as self-contained as possible.

(*b*) During an action only first-aid and life-saving procedures should be carried out, leaving operative procedures until after the action.

In a large ship there were at least three main dressing stations, each under the charge of a medical officer, and each shut off from the others by watertight doors. Non-medical ratings, previously trained to carry out conservative first aid, were stationed in every part of the ship, including gun turrets, magazines and transmitting stations. They carried small haversacks with dressings, tourniquets, morphia, antiseptics and splints, together

with labels of different colours to indicate the nature and severity of each case. These first-aid ratings could handle temporarily even serious injuries. In the case of haemorrhage, they were instructed to control the bleeding, and to apply sulphonamide powder and a dressing without moving the patient more than was necessary to make him relatively comfortable under cover. Morphine in a minimum dose of one-third grain was given and repeated if necessary. The fact that morphia or anti-tetanic serum had been given was recorded on the coloured labels. This system, if properly followed, enabled the medical officers to see at a glance the cases which needed urgent attention and the times at which morphia injections had been given.

Each dressing station was supplied with:

(*a*) an independent lighting system,
(*b*) its own supply of fresh water,
(*c*) its own means of sterilisation,
(*d*) its own transfusion apparatus, splints and instruments.

In addition, medical officers and sick-berth ratings were supplied with a head torch and pocket battery; these proved safe, convenient and efficient.

In all ships, of course, aid posts were established in those places where they would be of greatest use without being in the way. Stretchers and first-aid boxes were distributed and some of these boxes were kept in readily accessible places. In *Vendetta* an "action belt" was made for the medical officer in which morphia, syringes, tourniquet, scissors and shell dressings were carried.

After action the principal medical officer had to decide the site of his "hospital". The ideal site was, of course, the sick bay, but, if this had been destroyed, another site such as the wardroom was selected. Accommodation for the wounded was provided by special cots or by the use of hammocks and mattresses in a space adjacent to the hospital.

Methods of evacuating sick and wounded were in a state of flux. In the Royal Navy, fleet operations usually entailed short runs and battle casualty procedure had been shaped accordingly. In Pacific areas ships were sometimes in dangerous waters, with enemy bases at close range, for a considerable time. Because of the difficulty or impracticability of landing casualties in port, they had to be held on board, and both in large and small ships the difficulties involved could be acute. Surgeon Captain W. J. Carr considered that the hospital ship was the answer, but apart from the fact that a hospital ship did not usually arrive on the scene until about two days after an action, the risks of transferring casualties in waters where there were enemy submarines were considerable. Flattery mentions these and other objections:

> In peacetime a patient can be landed in almost any port in the world—it was clearly never visualised that in wartime the occasion would arise when the ship would have to be its own hospital ship, necessitated by long periods at sea, away from any hospital accommodation. Moreover, with the rapid changing from place to place as situation demanded, and the great loss of time involved in drafting a rating as a replacement, any patient landed was of necessity an interference with the fighting efficiency of the ship.

Under existing conditions it seemed inevitable that the concept of the warship as a warship only with no other functions would have to be modified.

In 1945 trials were made in H.M.A.S. *Australia* of different patterns of stretchers, the Neil Robertson type as supplied, and a modified Hedley type. These trials were made while the ship's company was at action stations, with doors and hatches closed. The Hedley had some points of superiority, such as greater length, affording more comfort, and an adjustable forehead strap. The buckles were of the ship type, with no pin needing adjustment, and handgrips were of webbing which made carrying easier. The flexibility of the Neil Robertson appeared at first to be preferable to the rigidity of the Hedley, but in practice the rigid type of stretcher seemed to be no less manoeuvrable in confined spaces. Surgeon Commander Flattery, who supervised the tests, considered that the Hedley type was more comfortable, safer for the patient, and easier in manipulation than the Neil Robertson.

In evacuating patients in whom it was desired to avoid pressure on injured areas—for example, those suffering from burns—the wire cage type, which had been tried with success in difficult carries in New Guinea, was used. This also provided easy transport from ship to boat and vice versa, and towards the end of the war was supplied to all cruisers and L.S.I. and to one or two smaller ships. For naval work it was, of course, important that stretchers should be suitable for slinging by a crane. When space was limited the ordinary army field stretchers were useful for transporting casualties over short distances, as they could be suspended from the ceiling by ropes in tiers of three. It was also important that stretchers should be of exchangeable pattern so that they could be replaced: for example, on the Tobruk run stretchers were, in theory at least, returnable by ships bound from Alexandria for Tobruk.

Other Installations Afloat. The *Whang Pu,* a river steamer, was commissioned by the navy on 1st October 1943 for conversion to a construction and repair ship. The sick bay afforded space for slinging 12 patients, and had a folding operating table. Accessory services such as those for pathological work and dentistry were provided. Surgeon Lieutenant N. L. Speirs and a Leading S.B.A. and an S.B.A. comprised the medical staff.

After travelling across the Bight, where those on board were able to study the considerable roll produced by the ship's high freeboard and shallow draught, the *Whang Pu* reached the naval base of Milne Bay on 6th June 1944. Next month she proceeded to Madang on the northern coast of New Guinea, taking up a position alongside Beliao Island, where tents were erected for medical work on shore. When *Whang Pu* arrived there were 2,500 R.A.N. personnel in the area who had no other source of medical care, and in the third quarter of the year the ship's medical section treated more than 3,000 patients, and Speirs carried out 41 operations.

At the beginning of the next quarter Beliao Island was commissioned as H.M.A.S. *Madang,* which took over most of the repair work that *Whang Pu* had been doing, but there was still no medical officer ashore,

and *Whang Pu* continued to provide medical care for Madang until medical staff arrived at the naval base later in the quarter.

Shore Accommodation for Sick and Wounded. Hospital accommodation on shore at the outbreak of war consisted of approximately 100 beds at Flinders Naval Hospital, 37 beds at the naval ward of the Repatriation Hospital, Randwick, Sydney, and a few beds in sick-quarters, at Garden Island, Brisbane, Fremantle and Adelaide.

By arrangement with the Department of Repatriation beds were available at Brisbane, Perth, Adelaide and Hobart, but although the Department was prepared to assist by providing additional beds at Brisbane and Perth, this accommodation was obviously insufficient for the rapidly expanding navy. The two ports which might have to provide facilities for the reception of large numbers of wounded after a ship or fleet action were Sydney and Fremantle, and the Repatriation Department agreed to make available to the navy at the time of the Munich crisis 100 beds at Sydney and 100 beds at Fremantle, if needed.

It had for some time been accepted as a broad principle, and was laid down in the War Book, that hospital accommodation for all Services would as far as possible be provided by the army. From the naval point of view this was dangerous and misleading, as no army beds of any description were available for naval patients during the 18 months after the outbreak of war, and, had it not been for the arrangement with the Repatriation Department, the navy would have been in serious difficulties during this period. This was not the fault of the army, which, although willing to cooperate, could not at first provide enough hospital facilities for naval patients. Indeed it was not until the large hospitals at Heidelberg, Concord and elsewhere were opened that accommodation could be provided, and by this time the navy had made its own arrangements. It may be noted here that R.A.N. hospitals and sick-quarters provided hospitalisation not only for the R.A.N. but also for the British, Indian, American, Free French and Dutch Navies, so that naval wards at times suggested the Tower of Babel.

As it happened, no shortage of hospital accommodation occurred when war broke out, but there is little doubt that a serious epidemic, such as influenza, or a sudden influx of wounded into Sydney, Fremantle or Brisbane, would have strained naval and other hospital resources to the utmost.

In Victoria the naval hospital accommodation available at the beginning of the war was increased by expansions at Flinders Naval Depot (H.M.A.S. *Cerberus*), which was eventually able to provide beds for 300 patients, and by taking over two buildings outside the depot to act as convalescent hospitals.

During 1940 the *Cerberus* sick bay was enlarged by the erection of galvanised iron buildings. These were unlined, a disadvantage under both summer and winter conditions, as was pointed out by Surgeon Commander A. Scott Mackenzie. In the next year an infectious diseases block and two other blocks were completed; a new galley replaced the archaic build-

ing which had outlived its usefulness at least 10 years before, and the sanitation services were improved. An X-ray department was added which housed a modern unit and facilities for chest microphotography, also a physiotherapy department fitted out with all modern equipment, but facilities for certain other types of investigation, such as neurological and neuropsychiatric, remained unsatisfactory. The medical staff consisted of 10 medical officers, 20 nursing sisters, 2 physiotherapists and about 80 sick-berth ratings. Of the sick-berth ratings, however, only a limited number had had previous training.

During 1941 Flinders Naval Hospital became a kind of clearing house, and large numbers of non-Australian invalids and others passed through for medical survey. Their condition required expert investigation, which often proved a lengthy process.

In order to save space in the hospital itself and to provide opportunities for convalescence away from the depot, two houses, one in the country and one in St Kilda, were taken over. The first was "Pine Lodge", Inverloch, a well-known guest house, about 60 miles by road from Flinders Naval Depot; it had a large swimming pool, two tennis courts, a nine-hole golf course, a large garden and a small farm. It could take up to 80 patients. The second was "Orwell", a house in St Kilda which was presented to the navy by Mr Archie Michaelis, M.L.A., and his sister. This could accommodate up to 20 patients and was very popular. Most of the work there was carried out by voluntary helpers and Red Cross workers.

Flinders Naval Depot treated most of its cases of zymotic and venereal diseases in contrast with the practice in Sydney. It also had a well-built and modern ward for the treatment of sick members of the W.R.A.N.S. Towards the end of the war, however, an increasing number of naval cases from ships and establishments in Melbourne were sent to Heidelberg Hospital or to the R.A.A.F. Special Hospital at the showground. The main reason for this, of course, was difficulty of transport, Flinders Naval Hospital being 46 miles from Melbourne.

In Sydney naval hospital accommodation existing at the outbreak of war was increased by taking over a second and then a third ward at Randwick; the three provided accommodation for approximately 12 officers and 100 men. The completion of the naval depot, H.M.A.S. *Penguin,* at Balmoral, on the north side of Sydney Harbour, provided an additional 50 beds in the well-equipped sick-quarters there, and two hutted wards built originally for the accommodation of V.D. cases became available for general purposes, as all cases of this nature were ultimately sent to the 120th Army Special Hospital, at Little Bay.

Still more accommodation was needed, however, and the choice lay between a ward or wards in the army establishment at Concord or the taking over of some other building. The second expedient was adopted, and "Canonbury" was selected. This was a large house on the harbour front at the end of Darling Point Road, the property of the Australian Jockey Club, which had been used as a convalescent home for children.

"Canonbury" was taken over by the navy on 28th May 1942 and was used as a hospital solely for non-surgical patients. It had equipment for all ordinary diagnostic or therapeutic purposes, including a Victor electrocardiograph, an Oxford vaporiser, two complete oxygen administration outfits with tents and face masks, a Krieselman resuscitator and an infrared lamp, and could accommodate up to 60 patients. It was staffed by 2 medical officers, 8 nursing sisters, one physiotherapist and 15 sick-berth ratings. "Canonbury" also became the headquarters of the R.A.N. medical organisation in Sydney under Surgeon Captain L. Darby.

Naval accommodation in Sydney consisted, therefore, of approximately 120 beds at naval wing, Randwick, 50 at *Penguin,* and 60 at "Canonbury", a total of 230 beds. Some cases of a special nature, such as psychiatric and those needing plastic surgery, were sent to army establishments. Generally speaking, this accommodation was sufficient, although it hardly provided the safety margin necessary in the event of heavy casualties from an action at sea or a serious epidemic.

During the later years of the war one of the wards at Balmoral was set aside for the W.R.A.N.S. *Penguin* sick-quarters at Balmoral as originally designed would have provided a naval hospital of 120 beds, including operating theatre, X-ray and pathological departments; with some additions in the way of outside hutted wards, it could have housed under the one roof all navy cases which, under existing arrangements, were scattered between naval wing, Randwick, "Canonbury" Hospital, and *Penguin* sick-quarters. This would have cut down overhead expenses, reduced staffs and provided a permanent R.A.N. hospital for peace as well as war. Unfortunately (in the opinion of the navy) this scheme was rejected by the War Cabinet on the grounds that the large hospital then in course of construction at Concord would meet the needs of all Services.

Fremantle. Before 1941 no naval hospital accommodation existed at Fremantle, all cases being sent to the Fremantle Hospital or to the Repatriation Hospital in Perth. The construction of a new depot at Preston Point provided approximately 20 beds for men and a small ward for members of the W.R.A.N.S. In November 1944 the navy took over one ward in the 110th A.G.H. at Hollywood, thus enabling the naval medical service to some extent to treat its own medical and surgical cases.

Cairns, Townsville, Brisbane and Canberra. Sick-quarters of a more or less uniform pattern were constructed at these four places. In addition to providing accommodation for a number of cases varying from 12 to 30, they also provided facilities for out-patient treatment, clerical work and a storage space for medical equipment. The sick-quarters at Brisbane was a particularly fine building and included recreation rooms, provided by the Queensland division of the Red Cross. Men with major illnesses and those cases needing operations were sent to the repatriation hospital during the first three years of the war and later on to army, air force, or in the case of Brisbane, to navy establishments.

Adelaide and Hobart. Sick-quarters in these ports provided from six to

ten beds. All cases of a serious nature were sent to repatriation or army hospitals.

In the capital cities specialist consultation and treatment could readily be obtained both for in-patients and out-patients. In the navy as in other Services the growing complexity of medicine increased the calls made on specialist services, and these were supplied by experts appointed on a part-time basis. General medicine and surgery were readily served by medical officers in the naval medical reserve, who were highly qualified and competent.

H.M.A.S. Melville, Darwin. Before the war there were no special facilities for housing the naval sick at Darwin, and they were sent to the civil hospital. After the entry of Japan into the war the population of the port increased rapidly, and naval hospital accommodation became necessary. At first a galvanised iron hut ward was provided, but this was unsuitable for the climate, and in the wet season of 1942 the increasing number of cases of dengue made it quite inadequate. A new sick bay was planned, but before it could be built the civil administration agreed to hand over to the navy one of the isolation wards of the civil hospital. As the building of Kahlin, the new civil hospital, went ahead, more accommodation became available and the navy took over a large ward. Here sick members both of the Royal Australian and the United States Navies, afloat and on shore, were treated. *Melville* sick bay was also maintained for attention to in- and out-patients with illnesses of a minor nature.

After the Japanese air raids on 19th February, when nearly all civilians left Darwin, Kahlin Hospital became vacant, and was taken over by the army, though the navy had occupied one of the general wards previously.[1] Early in 1945 the army vacated Kahlin and the navy took over the whole of the hospital as it stood, including the laundry. At that time it appeared probable that the Royal Navy would require up to 500 beds in the Darwin area, and from a naval point of view sole possession of this hospital appeared opportune. The medical staff consisted of 3 medical officers, 2 dental officers, 6 nursing sisters and 25 sick-berth ratings, together with cooks, stewards, and so on, supplied from the W.R.A.N.S. As, however, Darwin faded in importance as a possible R.N. base, and as R.A.N. activities became more concentrated in the waters north of New Guinea, the need for this hospital diminished and in 1945 it was returned to the civil administration. It had, however, served its purpose, and the navy was fortunate in acquiring a brand new hospital at the time it was most needed.

Thursday Island. A small sick bay which could accommodate up to 10 patients was constructed at Thursday Island. All severe cases were treated at the Government hospital which was taken over by the army.

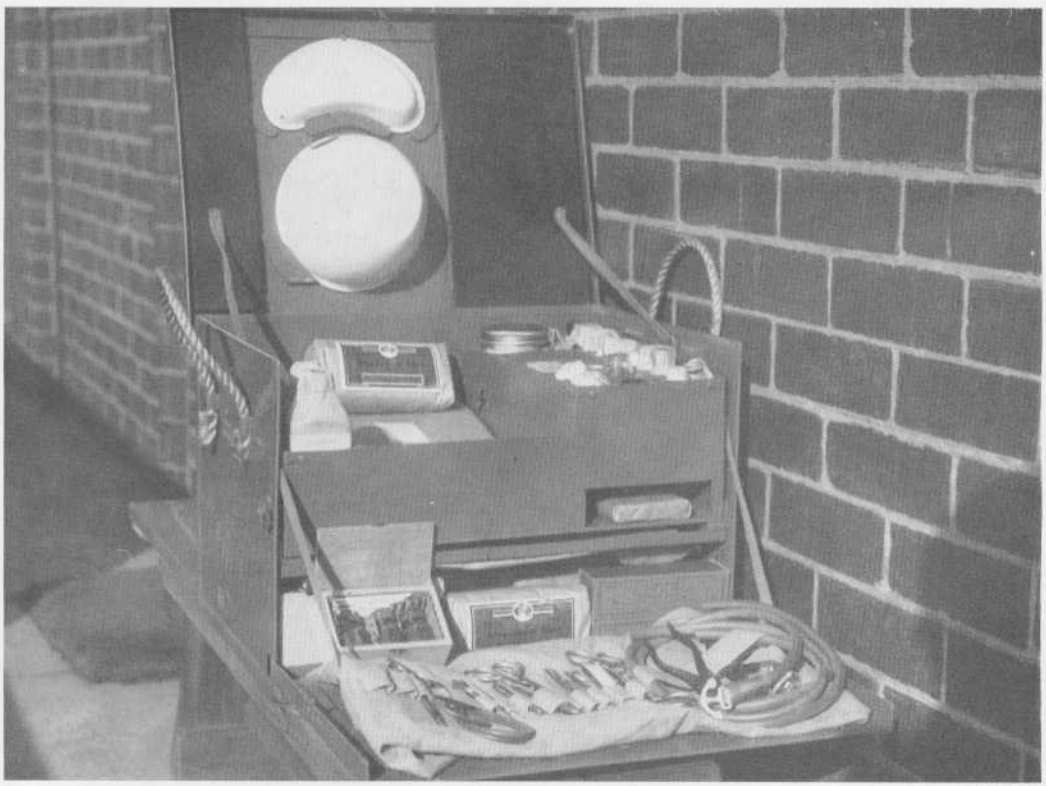
New Guinea. The first naval base in New Guinea was H.M.A.S. *Basilisk* at Port Moresby. A medical officer was appointed there on 22nd May 1942, and a sick-quarters set up in a converted house. This functioned

[1] Medical aspects of the raids are described in the following chapter.



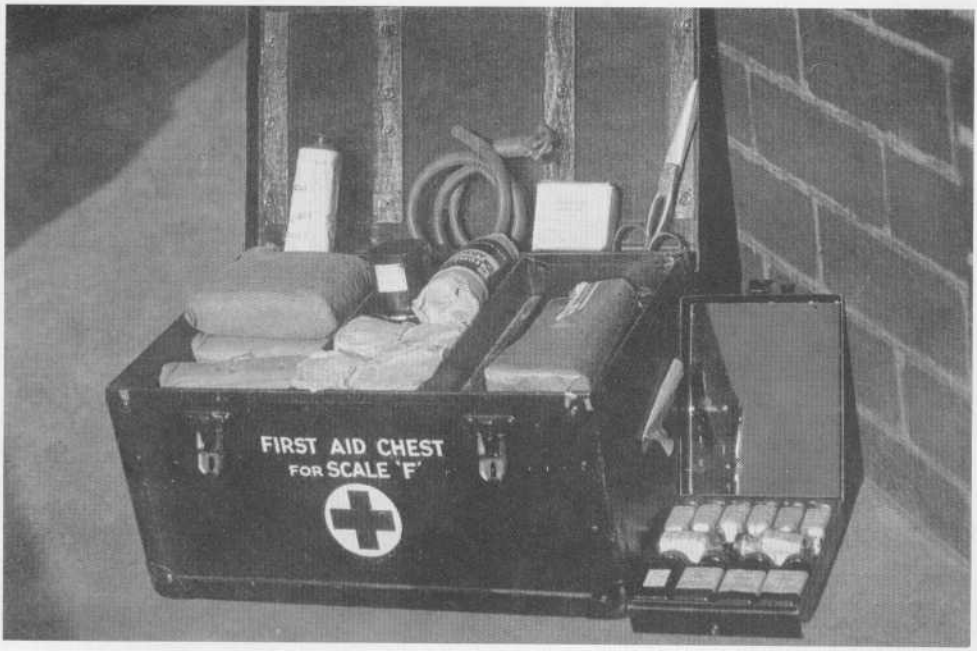
(R.A.N.)

R.A.N. Scale "C" set of panniers.



(R.A.N.)

R.A.N. Scale "E" set of panniers.



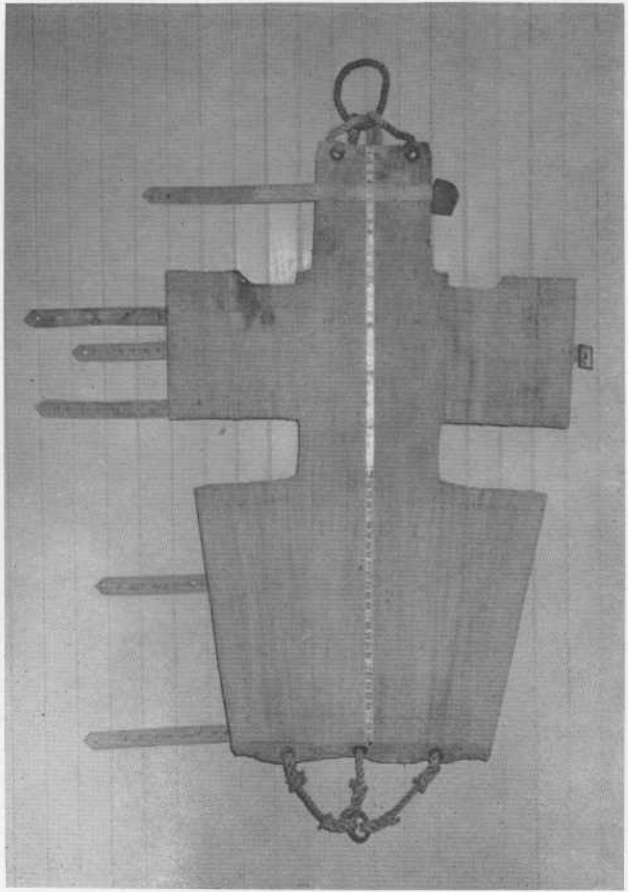
(*R.A.N.*)

R.A.N. Scale "F" chest.

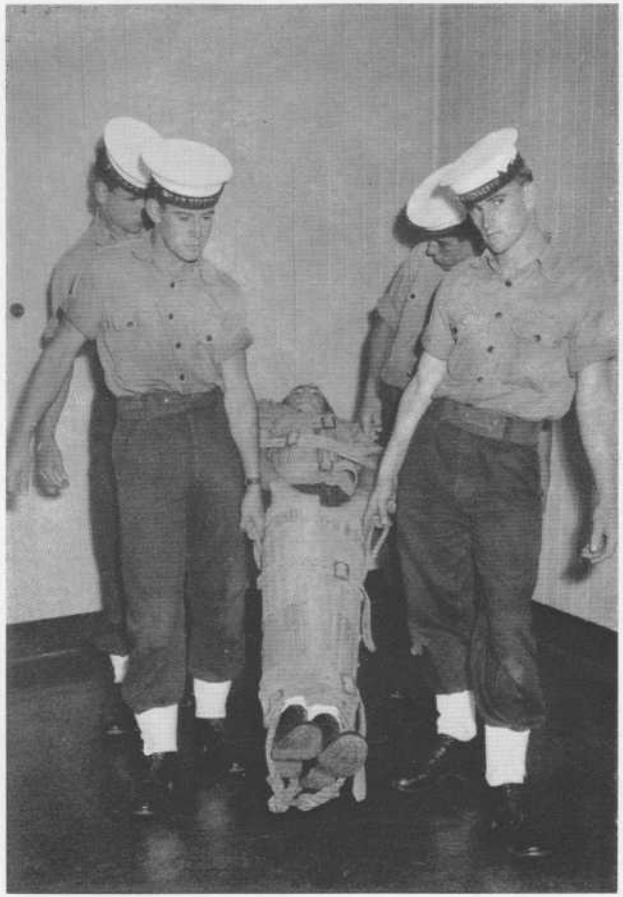


(*R.A.N.*)

R.A.N. Scale "H" set of tins.

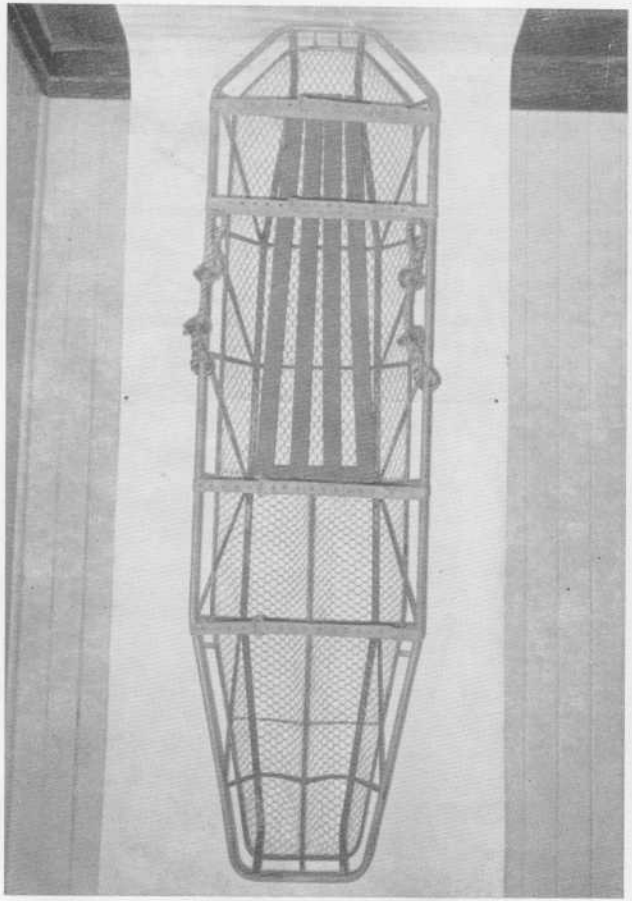


Neil Robertson stretcher, showing length in inches.



(R.A.N.)

Neil Robertson stretcher, loaded at the carry.



The Stokes litter.



(*R.A.N.*)

"Hedley" modification of Neil Robertson stretcher, involving increase in length from 5 feet 2 inches to 6 feet.

as administrative centre for the naval medical service in the area, and provided accommodation for cases of minor illness, all serious cases being sent, at first, to the Government hospital and later to army hospitals. The sick-quarters was closed down in 1945.

The next place to contain a naval sick-quarters was Milne Bay or, to use its naval title, H.M.A.S. *Ladava*. At first it consisted of a space under a house taken over by the navy and known as "Target House". From this primitive beginning it extended to a palm-thatched hut with concrete flooring. All serious cases were sent to hospitals of other Services in the area, especially to that of the R.A.A.F. Gradually the number of naval cases at No. 2 Medical Receiving Station R.A.A.F. approximated to those of the air force, and an agreement was made whereby the navy took over and staffed its own wards. Finally, in 1944 the R.A.A.F. turned the hospital over to the navy. When the R.A.A.F. moved out they took everything with them, and the navy had to set to and re-equip the hospital completely. It consisted of huts with palm-thatched roofs but proved very suitable. Six nursing sisters and some 20 sick-berth ratings provided nursing facilities. The principal medical officer was Surgeon Lieut-Commander C. K. Churches, who performed all operations. It was closed down in 1945 and most of the staff transferred to Kahlin Hospital, Darwin.

Milne Bay also had a subsidiary bulk medical store to provide for the medical and dental requirements of ships and establishments in the New Guinea area. At a later date this was moved to Madang, where the naval medical set-up has already been described.

In addition to the shore establishments at Port Moresby, Milne Bay and Madang the R.A.N. set up several land-based depots in tropical areas.

Naval medical facilities in New Guinea provoked the criticism of medical officers. In September 1944 Surgeon Lieutenant Speirs wrote:

> The whole position of the medical service in New Guinea is intolerable. Insufficiently staffed sick bays are located in several places, and it has been necessary to scrounge materials and to make repeated requests for transport and other items, the supply of which ought to be automatic.

Surgeon Lieut-Commander E. E. K. Bottomley also made some adverse comments:

> Undoubtedly the R.A.N. depots in New Guinea have been the worst constructed and most unhygienic of any Service. Port Moresby, where navy dwellings were taken over intact, is the outstanding exception.

These sweeping criticisms were probably expressions of the traditional naval insistence on the highest efficiency. Others will recall establishments of all Allies and Services which invited ungentle comment.

During the latter years of the war naval bases were moving so quickly that the policy of fixed establishments on shore was replaced by fitting up sick bays on ships which were acting as depot or repair ships in the area, such as *Platypus* and *Whang Pu*. These were suitable for the hospitalisation of minor cases, all serious cases being sent to army, air force or American hospitals if there were any in the vicinity.

To sum up, hospital accommodation for the Royal Australian Navy on the Australia Station at the peak of hostilities was available at:

Flinders Naval Depot, Victoria (H.M.A.S. *Cerberus*)	300 beds
Balmoral Naval Depot, N.S.W. (H.M.A.S. *Penguin*)	50 beds
Canonbury Naval Hospital, N.S.W.	60 beds
Naval Wing, Prince of Wales Hospital, Randwick, N.S.W.	120 beds
Naval Wing, Repatriation Hospital, Perth	30 beds
Milne Bay Naval Hospital, New Guinea	30 beds
Naval Hospital, Darwin, N.T.	60 beds

There was also a hospital for the use of the Royal Navy at Herne Bay, Sydney, with a maximum of 1,200 beds. In addition, sick bays were equipped at the following Naval Depots:

Fremantle, W.A.; Port Adelaide, S.A.; Hobart, Tasmania; Williamstown, Victoria; Rushcutter's Bay, Garden Island and Newcastle, N.S.W.; Brisbane, Townsville and Cairns, Queensland.

Subsidiary convalescent homes were established in Victoria at Inverloch, and "Orwell", St Kilda. In other States the various convalescent homes conducted by the Red Cross and other charitable organisations were used.

A directory of ports on the Australia Station issued to medical and dental officers of ships, gave details of the medical facilities and amenities available in each. The directory also provided information about climatic and other conditions relating to health, which was valuable to the medical officers of a Service which had frequently to adjust itself to changing conditions.

On oversea stations the arrangements for special shore attention for the sick usually followed the routines of the Royal Navy. In the Middle East —at Alexandria, for example—most naval patients, both medical and surgical, were taken by the 5th British General Hospital which had 1,500 beds, and was always able to admit patients. The standard of treatment was excellent. Specialist and consultant services of a high order were also given by the medical staff of H.M.H.S. *Maine*. In smaller centres diagnostic facilities were sometimes lacking; certain pathological tests could not be performed, and appointments for eye examinations and dental work were difficult to arrange, especially at short notice. These, however, were difficulties which were on occasions experienced in home waters.

CHAPTER 6

THE R.A.N. IN ACTION

IT was fortunate that at the outbreak of war the naval forces of Australia, though small, were well-balanced and ready to take up instantly any of the duties that circumstances might demand either in home waters or in combined service with the Empire and Allied forces. The First Naval Member and Chief of the Naval Staff, Vice-Admiral Sir Ragnar Colvin, was returning from a brief visit to England when war broke out, but under the Second Naval Member, Commodore M. W. S. Boucher, the switch from peace to war was made without difficulty.

The fleet of the Royal Australian Navy on 3rd September 1939 comprised two 8-inch gun cruisers, *Australia* and *Canberra,* four 6-inch gun cruisers, *Sydney, Hobart, Perth* and *Adelaide,* one flotilla leader, *Stuart,* four destroyers, *Voyager, Vampire, Vendetta* and *Waterhen,* two sloops, *Yarra* and *Swan,* the survey ship, *Moresby,* a depot ship, *Penguin* (ex *Platypus*), the boom working vessel *Kookaburra* and the fleet oiler *Kurumba. Adelaide* was 17 years old; the three other 6-inch gun cruisers were modified *Leander*-class, of around 7,000 tons. Built for the Royal Navy in the rearmament period of the 1930's, they were acquired and commissioned in the R.A.N. in 1935 (*Sydney*), 1938 (*Hobart*) and 1939 (*Perth*). The destroyers were all veterans of the 1914-18 War. Most of the ships were commanded and manned by officers of the R.A.N. who had graduated from the R.A.N. College and by men trained at Flinders Naval Depot.

As the war went on, the expanding scope of operations and the inevitable losses called for additions and replacements. In September 1939 two sloops were under construction: *Parramatta,* almost completed, and *Warrego.* Other ships were immediately necessary as minesweepers and armed merchant cruisers, and smaller coastal traders, trawlers and passenger liners were converted for these purposes. The Admiralty helped to augment Australian naval strength, and by this means and an active building program in Australia the following wartime additions were made: the 8-inch gun cruiser, *Shropshire*; the armed merchant cruisers (later converted to infantry landing ships), *Manoora, Westralia* and *Kanimbla*; the destroyers, *Nestor, Napier, Nizam, Norman, Nepal, Quiberon, Quickmatch, Arunta, Warramunga* and *Bataan*; the frigates, *Gascoyne, Barcoo, Burdekin, Hawkesbury, Lachlan* and *Diamantina;* 56 corvettes (Australian minesweepers), 3 boom defence vessels, 35 Fairmiles (M.L's), 28 harbour defence motor-launches and numerous merchant vessels taken up for naval service.

A great expansion of the medical services could be foreseen even in the early months of the war, though the reality exceeded most expectations. The personnel of the navy, which on 3rd September 1939 numbered approximately 5,000, was doubled almost overnight, and the medical

services were called upon to provide medical care for all sea-going and shore units.

The navy's immediate task was the defence of the Australia Station. *Canberra, Hobart, Voyager, Vampire, Swan* and *Yarra* at once began patrol duties in the waters off the east coast, while *Sydney* was based on Fremantle.

In October 1939 the cruiser, *Hobart,* and the five destroyers, *Stuart, Vendetta, Waterhen, Vampire* and *Voyager,* left Australian waters for Singapore. January 1940 saw the departure from Australia of the first convoy of Australian and New Zealand troops for the Middle East. *Canberra* and *Australia* augmented the escort by the battleship *Ramillies* from Sydney to Fremantle, where the two Australian cruisers were replaced by the British *Kent* and the French *Suffren.* After leaving Colombo *Hobart* joined the escorting warships and the troops reached their destination safely on 12th February.

Meanwhile the five destroyers after varied experiences had arrived in the Mediterranean, where they were a welcome addition to the British Mediterranean Fleet. Rear-Admiral J. C. Tovey, in addressing *Stuart's* complement on their arrival, forecast hard work and dull days ahead, and as time went on this appeared as an understatement. The destroyers were engaged mostly in convoy work, and during the winter months of 1940 they experienced intensely cold conditions, with strong winds and rough seas; ice coated their sides, and *Vampire's* torpedoes froze in the tubes. To add to the strain of the day-by-day work, quarters were close; the vitiated air did not circulate freely; water leaked into the mess decks, damping bedding and causing loss of sleep, and there was little fresh food because of the absence of refrigeration. Such living conditions were not conducive to good health: colds, influenza and bronchitis were common, and in July 1940 an advanced case of pulmonary tuberculosis was discovered in *Vampire. Vampire's* medical officer, Surgeon Lieutenant C. P. C. Reilly, also noted a deterioration in the men's mental outlook.

The five destroyers, *Stuart, Vendetta, Waterhen, Vampire* and *Voyager,* with a number of British destroyers were formed into the 10th Destroyer Flotilla on 27th May 1940, under the command of Captain H. M. L. Waller, R.A.N. The day before, H.M.A.S. *Sydney* arrived on the Mediterranean Station and joined the 7th Cruiser Squadron.

On 10th June 1940 Italy declared war. She had a powerful, balanced fleet, numerically superior in all categories to the British in the Mediterranean, with strategically situated bases. It was a weapon which could seriously menace Britain's Mediterranean communications.

The Australians were soon in action against the Italians. On 21st June Bardia was bombarded by a force which included *Sydney* and *Stuart.* During the action *Sydney's* Seagull aircraft narrowly escaped destruction when attacked in error by three R.A.F. fighters. Although damaged, it managed to reach Mersa Matruh.

France signed an armistice with Germany on 22nd June and with Italy two days later. The British forces were now left to defend alone the

vulnerable sea path from Gibraltar, past Malta and Alexandria to Haifa. The narrow channel of 75 miles between Tunisia and Sicily and the neighbourhood of Malta held particular hazards. From this time until November of the following year Australia's representation with the Mediterranean Fleet was never less than a cruiser and four destroyers.

On 28th June *Sydney* operating with ships of 7th Cruiser Squadron had her first engagement with an Italian force at sea, and the Italian destroyer, *Espero,* was sunk. To pick up survivors in narrow waters near enemy-held shore bases was a dangerous operation. *Sydney* picked up 47, including 12 seriously wounded. Injuries included extensive burns and several fractures. One man suffered from a corneal ulcer due to burns, and here, as in other actions, burns involving the ocular regions caused great pain. Morphine was given freely as soon as patients reached the sick bay, and four anaesthetics were administered to allow fractures to be splinted. Three of the patients, who had severe wounds incidental to fractured femur, with great blood loss, died within 36 hours. The rest were nursed on board until they could be discharged to hospital.

Owing to the risk of submarine attack *Sydney* and the destroyer force were forced to move on quickly from these waters. The cruiser left a cutter floating with food and water for those who were able to reach its haven. Bombing attacks were made by the Italians before the ships reached Alexandria, but no casualties or damage resulted at this time. In the first three weeks of the war the Italians also lost six submarines to British attacks in the Mediterranean. *Voyager* was involved in two of these actions, the sinking of the *Console Generale Liuzzi* on 27th June and the *Uebi Scebeli* on 29th June.

On 4th July there was a heavy air raid on Alexandria and here, and on the sea route to Port Said, the Australian ships were attacked, though they escaped serious damage.

Five days later the Battle of Calabria—the first major naval action with the Italians—took place. The British forces included the Australian ships *Sydney, Stuart, Vampire* and *Voyager.* The Italian forces were repelled decisively. In spite of heavy air bombardments before and after the action, there were no British casualties. *Vampire* while escorting a convoy from Malta to Alexandria suffered the flotilla's first battle casualty when Commissioned Gunner J. H. Endicott, R.N., was mortally wounded during a low-level bombing attack.

Later in the month, *Sydney,* working with British destroyers, engaged two Italian cruisers and in an early morning action off Cape Spada, the north-western extremity of Crete, sank the Italian cruiser, *Bartolomeo Colleoni,* and damaged her sister ship, the *Giovanni delle Bande Nere.* This action illustrated the problems involved in the rescue of survivors from a sunken or sinking ship. The British destroyers, *Hyperion, Ilex* and *Havock,* stopped to rescue men from the *Bartolomeo Colleoni,* and succeeded in picking up 545. As a result of the delay, and hampered in anti-aircraft defence by having their decks crowded with demoralised

prisoners, the destroyers—and *Sydney* who had turned back to help them —later suffered heavy air attacks, with some damage to *Havock*.

A second bombardment of Bardia was carried out on 17th August, and *Stuart, Vendetta* and *Waterhen* supplied screening for the heavy British ships taking part. Later in the month *Stuart* was one of four destroyers which bombarded the Italian base at Bomba, and on the same night, 23rd-24th August, *Sydney* and *Waterhen* were included in the force which again bombarded Bardia.

To the south British land forces had met with a temporary reverse. British Somaliland, which lay between Italian Somaliland and the Gulf of Aden, was invaded by a large Italian force. Greatly outnumbered and without adequate equipment, the British had no hope of making an effective resistance and evacuation was determined upon. In this operation, which was carried out from Berbera, H.M.A.S. *Hobart* played a major role.

The evacuation began on the night of 15th August. The task was most difficult to carry out from a port with rudimentary facilities, and in the face of the strong south-west wind that blows for part of every day throughout the summer months.

The sea transport officer reported that the base hospital in Berbera was overcrowded, and asked for the embarkation of Indian patients. The British hospital ship *Vita* was at hand, and Surgeon Commander H. G. Wells landed from *Hobart* with the staff to assist in the movement of patients. The task was complicated by air raids and lack of ambulance transport, but an old motor truck was used to transport stretcher cases and walking wounded from both the African and Indian hospitals. On the 16th some 80 patients were taken direct from the shore to *Vita* by a lighter, pinnace and tug. The handling of these patients was a manoeuvre requiring both seamanship and resolution and was accomplished with entire success.

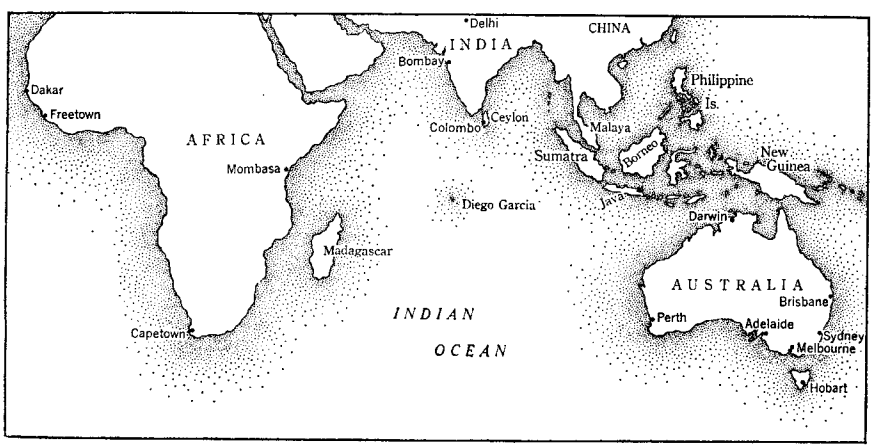
The evacuation of civilians also proceeded smoothly. Some 1,100 of the civil population, including Abyssinian women and children, were taken aboard the armed merchant cruiser *Chakdina* and, after delays due to air raids later in the day, they sailed for Aden. An Italian column advancing along the coast road from Zeila was held up by gunfire from H.M.S. *Ceres* on patrol, and on the evening of the 17th a rapid and orderly embarkation of troops began.

A temporary sick bay was set up in a tent on shore, where *Hobart's* medical personnel were able to give attention to wounded troops until they could be transferred on board. There they were accommodated in the sick bay and on the starboard shelter deck, which was fitted with 30 army-type stretchers. Some of the patients were seriously injured, and required operation. Transport and medical work were made more difficult by further air attacks. When embarkation was completed, *Hobart's* demolition parties carried out their work on shore, and on the morning of the 19th, the cruiser left for Aden, having bombarded Government House and offices.

In all, 5,690 troops, 1,266 civilians, and 184 sick and wounded were taken off, and only one tug was lost. The operation reflected great credit on *Hobart,* which acted as operational headquarters, and on the British naval vessels and merchant ships taking part.

Hobart had now been in tropical areas since October 1939 when she arrived at Singapore. Next month she began patrols and convoy escort duties between India and the Gulf of Aden. In the Red Sea region conditions were particularly trying: it was impossible to keep the sick bay at a suitable temperature, and two patients, one of whom had had an anaesthetic, died in hyperpyrexia. Subsequently few clinical or even subclinical states of heat exhaustion were noted, due no doubt to the fact that the medical officer had impressed personnel with the necessity for a regular and sufficient salt intake with their food.

At the outbreak of war H.M.A.S. *Perth* had been the only R.A.N. ship in western longitudes. She was in the Caribbean Sea and remained in this area and in Atlantic and Pacific waters until March 1940, when she proceeded for Australia. An increasing number of Australian permanent and reservist personnel were now serving in the Royal Navy in Scandinavian, British and Atlantic waters. The R.A.N. was further represented when *Australia* sailed via the Indian Ocean for the Atlantic at the end of June. *Australia,* after delivering a convoy from Capetown to Freetown,



sailed on 4th July to join the British forces off Dakar, where they were engaged in the melancholy task of preventing powerful units of the fleet of their one-time ally, France, from falling into German or Italian hands. During the following months *Australia* was in the northern Atlantic zones, even entering the Arctic Circle north of Norway.

One of the rapid environmental changes characteristic of naval activities brought *Australia* back to Dakar in September with units of the Home Fleet. Attempts to persuade the forces at Dakar to ally themselves

with the Free French failed and hostile action took place. *Australia* patrolled Dakar for a time, engaged ships and shore batteries, and succeeded in disabling a French destroyer. On 24th and 25th September action continued, and on the 25th *Australia* was hit. Only superficial damage was sustained, but her Walrus aircraft was shot down, and the crew killed. There were no specially notable medical features, although action conditions illustrated the inadequacy of the space set apart for the sick bay. It was already evident that either landing or retaining casualties created difficulties, and restricted space limited the amount of medical work that could be done efficiently.

After the Dakar operations *Australia* proceeded to the United Kingdom, where she joined the 1st Cruiser Squadron at Scapa Flow. At the end of 1940 she was at Liverpool for refit, and while in dry dock there narrowly escaped damage in recurring air raids.

Meanwhile in the eastern Mediterranean British naval reinforcements had arrived. On 4th September, in the course of a British attack on the Italian Dodecanese, H.M.A.S. *Sydney* bombarded an aerodrome on Scarpanto Island without damage to herself. Later in the month *Stuart* successfully attacked the Italian submarine *Gondar* which was scuttled by its crew. *Stuart* rescued 28 survivors, and 19 others were picked up by a trawler. She then proceeded to Malta for a refit, which was not completed until January 1941. In a Malta convoy operation in October *Sydney* and *Vampire* were present at the destruction of the Italian destroyer *Artigliere* which, having been crippled in a night engagement with H.M.S. *Ajax,* was sunk soon after daylight next day by gunfire from H.M.S. *York. Vampire* picked up 22 survivors from a raft, and Admiral Cunningham, in a plain language signal, told the Italian Admiralty of the position of rafts with other survivors, who were later rescued by their own people.

On 28th October Italy invaded Greece, and although Britain's offer of military aid was not immediately accepted, the event had its effects on the dispositions of the British Mediterranean Fleet. Some ships were diverted to convoy duties to Piraeus and to Suda Bay in Crete, where a British base was being formed, and an attack was planned on Taranto with the object of inhibiting an attack on Greece by the Italian Fleet. For the purpose of the Taranto attack the reinforced Mediterranean Fleet assembled a considerable strength on 11th November, using the Fleet Air Arm from one carrier (*Illustrious*), escorted by four cruisers and four destroyers. Meanwhile *Sydney* and other ships of the 7th Cruiser Squadron headed for Otranto at the entrance to the Adriatic. While this force carried the attack into the Adriatic, destroying an Italian convoy of four ships, the Fleet Air Arm at Taranto succeeded in crippling three battleships and destroying other vessels.

As a forerunner of the Western Desert offensive Australian ships, including *Perth,* which had arrived in Alexandria from Australia on 24th December, were operating off the Libyan coast. They sank a number of small Italian transport vessels and *Voyager,* on a patrol between Bardia

and Tobruk on 30th December, captured the Italian ketch *Zingarella* with the help of nine British prisoners of war on board.

So closed a busy year for those R.A.N. ships in the Mediterranean, where winter conditions now prevailed again. As the destroyers came in turn for refit an effort was made to improve living conditions on board, particular attention being paid to ventilation.

The first months of 1941 were favourable ones for the British Mediterranean Fleet. In an action off Cape Matapan on 28th March the British for the loss of five aircraft sank three Italian cruisers and two destroyers, as well as damaging the battleship *Vittorio Veneto*. *Perth* and *Stuart* took part in this action.

In the Balkans, however, the situation was not propitious. At the end of February the Greek Government had accepted Britain's offer to send troops to Greece, and three British Dominion divisions were committed. On 6th April Germany invaded both Yugoslavia and Greece. *Perth,* which was at Piraeus on that day, was involved in a raid by German aircraft. One watch was on leave ashore, and the forward medical station was manned by Surgeon Lieut-Commander E. M. Tymms, Surgeon Lieut-Commander (D) D. O. Southby, a sick-berth petty officer and a leading sick-berth attendant. A stretcher party was mustered at the after station. Within a few minutes a merchant ship, the *Cyprian Prince,* anchored a few cables ahead of *Perth,* was twice hit and sank. A ship's boat was sent to pick up survivors, and with the aid of a stretcher hand four men were promptly rescued. They recovered quickly from mild shock and immersion. Another merchantman, s.s. *Kohistan,* lying near by also picked up survivors, and during an intermission of bombing the medical officer and L.S.B.A. from *Perth* went on board the *Kohistan,* and treated numbers of men suffering minor injuries and several who were suffering from concussion and bomb blast. One man had severe bleeding from a facial artery: he was taken back to *Perth,* and in the sick bay the artery was successfully exposed and ligated. Several of *Perth's* company, who were ashore at the time, were injured, and some were blown into the water by explosions, fortunately without serious effects.

Yugoslavia was unable to withstand the onslaught of Germany's land and air forces, and by mid-April had capitulated. In Greece a similar end could be foreseen, and on 21st April, in agreement with the Greek Government, it was decided to evacuate the British forces. This difficult task fell to the R.N. and the R.A.N. Troops, including sick and wounded held by medical units, were collected at several evacuation beaches, and in a series of night operations large numbers were successfully transported by sea to Crete and to Egypt. The Australian ships participating were *Perth, Stuart, Vampire, Voyager, Vendetta* and *Waterhen.* On 24th April *Voyager* took off 161 Australian, New Zealand and British nursing sisters, and on the 27th *Perth* embarked 850 Australian and British troops. For this operation a stretcher party with Neil Robertson and army pattern stretchers was stationed at each boarding gangway, and the medical stations fore and aft were fully manned. The army stretchers were useful

for holding cot cases on the deck of the sick bay, and four patients were so accommodated. Five men with dysentery were isolated in the petty officers' recreation room under the care of a sick-berth attendant. One man, seriously wounded by shrapnel, had to be operated on while on board. Most patients were landed on Crete at Suda Bay, but six wounded were kept on board owing to scanty shore facilities, and they were taken to Alexandria and transferred to a British army hospital. The cabin which had been used for dysentery patients was fumigated and closed.

During 21st and 22nd May *Perth* was subjected to prolonged and intensive air attacks, and many near misses were experienced. Her complement suffered injuries from bomb blast and shrapnel and her decks were frequently machine-gunned, causing further casualties. Supplementary defence from rifles was called for. The sick-berth staff gave constant attention to casualties during this long period of strain.

When Crete too fell before the German advance the navy was faced with another tremendous evacuation operation. On the night of 28th-29th May two cruisers and six destroyers took off nearly the whole British and Australian force at Heraklion, but, after the troops had embarked, dive bombers attacked and two of the destroyers were sunk, and the cruisers received a number of hits, many of the troops on board being killed. Because of the naval losses at Heraklion only a depleted naval force was available to take off those troops who had made their way on foot by a precipitous route to the small beach of Sfakia. *Perth, Stuart* and the Australian-manned *Napier* and *Nizam* were included in the British naval force taking part in this operation. The risky manoeuvre of transferring troops by boat to the waiting ships was carried out with success. *Perth* embarked 1,188 men from Sfakia in the early hours of the 30th. Wounded were placed on stretchers and forms in the captain's day cabin aft, and in the forward petty officers' mess and recreation room; sitting patients were disposed round these compartments. Care was taken to reserve cot space for further casualties which might be received during the trip to Alexandria, and this was fortunate as, on the way, *Perth* sustained a direct hit when a bomb exploded in "A" boiler room, and put the forward unit out of action. Four naval personnel, two marines and seven soldiers were killed, and several men wounded. In the crowded conditions on board the immediate disposal of the dead posed a problem; later they were buried at sea.

Most of the wounds sustained were flash burns of the eyes and exposed extremities, particularly among soldiers, who of course were without the protection of anti-flash gear; other wounds were caused by flying shrapnel and splinters, and damage was done to the ear drums by blast. The protective value of rubber ear plugs or wool plugs was evident, and men failing to plug their ears often paid the penalty in varying degrees of loss of acuity of hearing.

Through the night and following forenoon medical attention was given to the wounded; castor oil was used to treat injured eyes, and "Tannafax" for superficial burns, and some 120 surgical dressings were applied.

Because of the heavy vibration at high speed, the application of dressings was far from easy, and the captain's day cabin aft was found to be the most suitable place for carrying out this work. First field dressings and triangular bandages proved valuable in saving time. Medical supplies had been reduced by damage from near misses, but by calling on the supplies placed in the medical stations all needs were met.

Experience in action in these waters showed that the sick bay was inadequate to accommodate more than a few casualties. The decentralisation of stocks of medical supplies, however, allowed trained sick-berth staff, suitably equipped, to be dispersed among the casualties.

Of a force of more than 31,000 British, Australian and New Zealand troops about 17,000 were taken off Crete, of whom 16,511 reached Alexandria. The British Mediterranean Fleet in the battle for Crete lost three cruisers and six destroyers. In addition, two battleships, an aircraft carrier and a number of other vessels were severely damaged. Admiral Cunningham described the operations as "a disastrous period in our naval history".

Tobruk had been captured on 21st January by troops of the 6th Australian Division, supported by a sea bombardment from *Stuart, Vampire, Voyager* and two R.N. vessels. Later the British Army in Libya was forced to retreat and by April was back on the Egyptian frontier. The Australian destroyers in the Mediterranean were now largely concerned with keeping open communications with Tobruk which, garrisoned largely by Australian soldiers, was entirely cut off except by sea. The destroyers were conspicuously successful in carrying out the "Tobruk run" between Alexandria, Tobruk and Mersa Matruh, bringing supplies and reinforcements, and evacuating wounded and men on leave.

Waterhen's routine was typical of that of the other destroyers. On the inward journey to Tobruk stores and ammunition were loaded on the upper deck, and reinforcements were carried. Most of the loading and unloading was done by the ship's company; this took from about midnight to 2 a.m., by which time it was essential for the destroyer to have left for Matruh with her quota of wounded and unwounded troops. These occupied places in the seamen's mess decks, and often the seamen could rest only in odd corners of deck space exposed to the discomforts of wind and sea. Even so, numbers of them spent their watch below in tending the wounded. Surgeon Lieutenant S. E. L. Stening, *Waterhen's* medical officer, noted the fatigue suffered by the men who did this on each return run. It was not surprising that enteritis was a common complaint among them. The numbers carried were in themselves formidable. During one quarter, 2,983 members of all Services were transported by *Waterhen,* of whom 1,005 were wounded. Occasionally the seamen had to start loading again in port as soon as unloading was finished. Later a new routine was adopted which allowed a break of a night in hammocks in port.

Vendetta on her first Tobruk run left Alexandria at 7.30 in the evening of the 8th May, and at 1.45 in the morning of the 10th began disembark-

ing 150 men and 25 tons of stores at Tobruk. Ninety stretcher cases and 250 others were carried on the return trip. Captain E. F. Mackenzie, A.A.M.C., and two A.A.M.C. orderlies embarked to look after the wounded. The equipment taken included one army pattern surgical pannier, one army pattern medical pannier, 80 mattresses, 20 army stretchers and 3,000 blankets. Patients were loaded from lighters, and stretchers were taken along the cleared forward mess deck, and mattresses placed on the deck and lockers. Cot patients were, as far as possible, transferred to mattresses; others were left on stretchers. An attempt was made by the naval medical officer to assess the degree of movement which could be permitted in each case; patients fit only for stretcher carriage were noted, and others who could get down ladders with assistance were taken aft. The coxswain and S.B.A. saw that the available space was used with economy and supervised the patients in forward mess decks. All stretcher cases which could not be accommodated below decks were placed in rows on the starboard side of the iron deck. In spite of the erection of a canvas screen to protect them, they were made miserable by the wind and spray, though exposure was reduced to some extent by each man being given at least two blankets. No stretcher cases could be placed on the port side, as the sea was coming over the deck. On the first run the ventilation was not working forward, but later on it improved and a corresponding improvement was noticed in the men's condition. Surgeon Lieutenant A. G. Campbell stated that if the voyage lasted over 16 hours the numbers carried would have to be drastically reduced. Only superficial attention could be given to the wounded: morphia was administered to the few men needing it, and dressings were changed where urgently required. Because of the unfavourable conditions no attempt was made to carry out surgical work after air raids. In fact, very little nursing could be attempted and hygiene was improvised. Hot tea was available to those wanting it: on later runs the galley sometimes provided two meals, though as a rule this could not be attempted.

Surgeon Lieutenant A. H. Robertson of *Voyager* described the difficulty experienced when men with fractured limbs had to be picked up from a mined ship off Tobruk. The problem was how to lift them out of boats or out of the water. In *Voyager,* with its low freeboard, the problem was partly solved by using a plank at the bottom of a hammock. As in the other destroyers, conditions on board were uncomfortable: ventilation was almost non-existent owing to the compulsory blackout, and a dense curtain of steam pervaded the engine-room. Yet a high standard of service was given to wounded and other troops between Tobruk and Matruh and the crew remained cheerful, making no complaint about the extra work and responsibility placed on them.

After July 1941, when the policy of using the fast minelayers *Abdiel* and *Latona* supported by destroyers was put into effect, two "N" or other large destroyers were used, and one of the smaller types such as "H" or "D" which replaced the older "V" types. This method of evacuating sick and wounded was most successful and had an excellent effect on

morale. Fifty lying patients could easily be taken in a destroyer; and, if necessary, even 100 in addition to 150 ambulant patients; they were loaded on to lighters by a simple method of slinging with short ropes, introduced by Surgeon Lieutenant T. A. McLean of *Stuart.*

Waterhen, after making 26 runs on the Tobruk Ferry Service, was sunk on the 30th June 1941. Since coming to the Mediterranean in December 1939 she had sunk a small Italian supply ship off the Libyan coast, and, when the Danish tanker *Marie Maersk* was bombed and burning in the Aegean, had put on board a volunteer crew who got the engines working and sailed her to Suda Bay. She had also attempted a tow of the hospital ship *Vita,* which had been bombed at Tobruk, and after failing in this, rescued about 490 patients and members of the medical staff. Happily there were no casualties when *Waterhen* sank.

Australia's second loss of a ship in the Mediterranean was the sloop *Parramatta,* which was torpedoed on the 27th November while en route to Tobruk; the commanding officer and nine officers were lost with 128 ratings. After a period of minesweeping in Australian waters *Parramatta* had joined the Red Sea Force in July 1940 for sweeping, patrol and escort duties, and had entered the Mediterranean in May 1941. When H.M.S. *Capetown* was torpedoed in April 1941 she had towed the cruiser from Massawa to Port Sudan. In June while *Parramatta* with H.M.S. *Auckland* was escorting the petrol carrier *Pass of Balmaha* from Alexandria to Tobruk they had been attacked by successive waves of enemy aircraft. *Auckland* was sunk, *Parramatta* rescuing 164 survivors. When *Waterhen* and *Vendetta* arrived on the scene, *Pass of Balmaha* was safely delivered to Tobruk.

To the east in Persia and Iraq the Axis threat to British interests was increasing. To counter it a British naval force, acting in concert with British and Soviet land forces, appeared at the head of the Persian Gulf in August 1941. Australia was represented by H.M.A.S. *Yarra* and the armed merchant cruiser H.M.S. *Kanimbla,* manned by an R.A.N. crew.

Yarra for the first year of the war had been employed in patrol, escort and minesweeping duties on the Australian coast. Proceeding to the Red Sea, she had taken part in the action which led to the destruction of the Italian destroyer *Francesco Nullo.* She was transferred to the Persian Gulf in April 1941. *Kanimbla* after leaving Australia in December 1939 had carried out patrol and escort duties on the China Station and in the Indian Ocean.

The operations in the Persian Gulf were completely successful. Persian warships lying at the entrance to the Karun River were immobilised, the naval barracks occupied and the oil refineries and storage tanks at Abadan secured. Seven Axis merchant ships interned at Bandar Shapur were captured and one was destroyed by fire.

The Australian ships stationed in the Mediterranean had gradually been recalled to eastern waters as the threat to Australia itself increased, or as refits became necessary. *Vampire* had left in May, *Perth* and *Voyager* in July, *Stuart* in August and *Vendetta* in October. *Hobart*—which had

arrived in the Mediterranean in July 1941—left in December, followed by H.M.A.S. *Yarra.* In the first week of 1942 the three Australian-manned destroyers of the 7th Flotilla, *Napier, Nizam* and *Nestor,* also left to join the Eastern Fleet. For the first time for over two years there were no Australian ships in the Mediterranean.

The events of 1940 had not allowed Australia the illusion that war was remote from her shores. Passenger and cargo ships on or near the Australia Station had been attacked by German raiders, including the 16,700-ton passenger liner *Rangitane*; Nauru had been shelled, and enemy minefields laid in coastal waters, leading to the loss of three British ships and one American. When Italy entered the war on 10th June 1940 the Italian ship *Remo* was seized by the Australian Navy at Fremantle, while *Romolo,* which slipped out of Brisbane on 5th June, was stalked by *Manoora* and scuttled by her crew when overtaken by the armed merchant cruiser on 12th June.

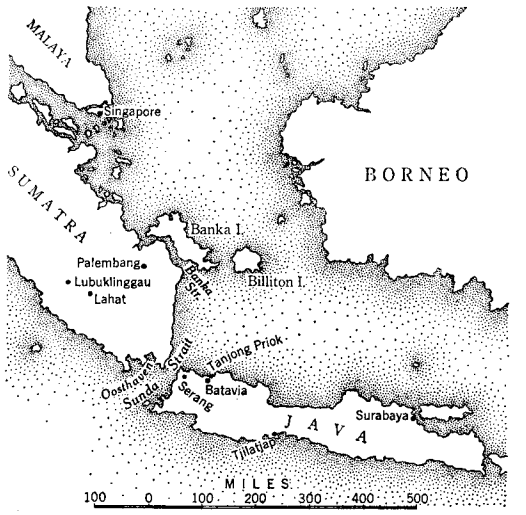
In March 1941 *Canberra,* on patrol in the Indian Ocean, intercepted the German blockade runner *Coburg,* and the Norwegian tanker *Ketty Brovig,* on which a German prize crew had been placed. Both ships were scuttled when the *Canberra* opened fire. A few months before, in November 1940, *Canberra* had picked up survivors from the *Port Brisbane* which had been sunk by the raider *Pinguin.* Meanwhile, *Sydney,* which had returned to Australia early in 1941, was engaged in escorting troopships for Malaya from the West Australian coast to Sunda Strait. In November 1941 she fell victim to the German raider *Kormoran* and all on board—645 officers and men—were lost. *Sydney* crippled the raider which was scuttled by her crew, whose survivors, picked up on the West Australian coast or in near-by waters off Shark Bay, provided the only account of the action.

Japan entered the war on 7th-8th December. At this time Australia had in the Singapore area the destroyers *Vampire* and *Vendetta,* the latter in the dockyard, and the four corvettes, *Bendigo, Burnie, Goulburn* and *Maryborough,* which previously had been engaged in minesweeping, patrol and escort duties around Malaya. *Manoora* and *Kanimbla* were also in Malayan waters.

Allied sea power was seriously depleted three days after the bombing of Pearl Harbour by the loss of the British battleship *Prince of Wales,* and the battle cruiser *Repulse. Vampire* was on the destroyer screen of these ships and was able to rescue 225 survivors.

To the Australian ships around Malaya, *Hobart, Yarra* and three more corvettes, *Ballarat, Toowoomba* and *Wollongong,* were added in January. In February Singapore Island was under attack, and the ships on patrol were kept on the alert by the frequent air attacks on shipping. On the 5th of the month the crowded troopship *Empress of Asia* when approaching Singapore was attacked by dive bombers and badly hit. Commander W. H. Harrington took *Yarra* alongside the burning vessel and rescued 1,804 men, *Yarra* meanwhile keeping up an effective fire with her anti-aircraft guns and bringing down some of the enemy planes. *Bendigo* and

Wollongong rescued the remaining survivors. On 14th February *Ballarat,* when north-west of Batavia, came upon a most extraordinary collection of boats and makeshift rafts, containing 215 survivors from the merchant ship *Derrymore,* which had been torpedoed. They were scattered over a wide arc of sea, and the dangerous and arduous task of rescue took many hours.



After the fall of Singapore further successes of the Japanese made it necessary to evacuate Sumatra, and in this operation the corvettes played a prominent part. *Burnie* and *Goulburn* supported the movement at Oosthaven, *Burnie* picking up the rearguard and *Ballarat* conveying there a party of R.A.F. to salvage some important material which had been left behind. *Wollongong* and *Bendigo* were at Palembang and *Toowoomba,* detached on 13th February in Banka Strait to go to the aid of burning oil tankers, picked up 42 survivors from the tanker *Merula.* These and other Allied ships were under the general command of "Abdafloat"—the officer commanding ABDA naval forces (Admiral T. C. Hart, U.S.N. from 15th January till 14th February; Vice-Admiral C. E. L. Helfrich, R.N.N. from then until 1st March). Both *Hobart* and *Perth* were included under this command. After an air attack on 3rd February *Hobart* went to the aid of a badly damaged British ship *Norah Moller,* with numbers of wounded on board, the treatment of whom is described in a later chapter. The intensity of air attacks increased towards the end of the month, and on the 25th *Hobart,* then at Tanjong Priok, was delayed in fuelling because of bomb damage to the auxiliary oil tender. This prevented her from being present at the Java Sea battle two days later.

Perth arrived in the ABDA area on 24th February, and from then on the crew had no respite from action stations. The general health in the ship was excellent, but, arriving in a tropical zone from a temperate one, the contrast in environment on board was very marked. Men below decks suffered badly from heat exhaustion when the ship was at first or second degree of readiness. Surgeon Lieutenant Stening was concerned by the temperatures in certain parts of the ship under action conditions. These were the engine and boiler rooms, the after steering position and the shell-handling rooms. With all hatches closed and fans turned off, there was a minimum air circulation and a maximum of humidity. The wearing

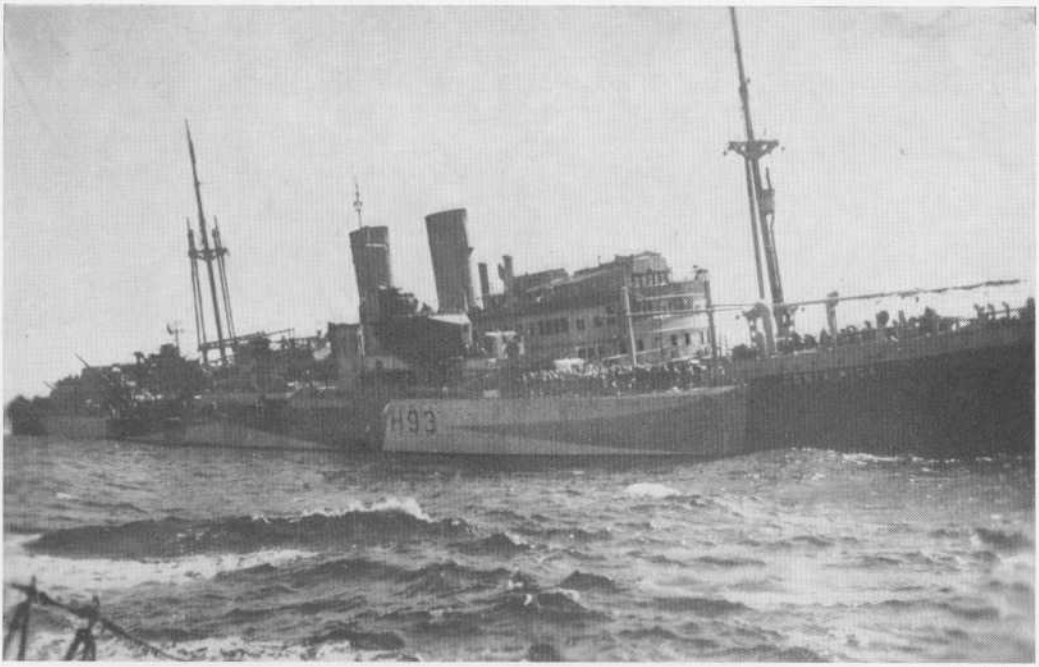
of anti-flash gear, while necessary, added greatly to the men's discomfort, as did the white overalls worn by some officers, including medical and dental officers.

It had been the practice to give first-aid lectures during the dawn and dusk periods of action stations, but this was discontinued in the tropical battle area because of the discomfort and for reasons connected with morale.

On the 27th February a large enemy force was found to be approaching Java, and was engaged by an Allied force of five cruisers and nine destroyers, comprising Dutch, United States, British and Australian units under the command of Rear-Admiral K. W. F. M. Doorman, R.N.N. During an action in the afternoon the Allied ships were straddled by heavy fire, and the British cruiser *Exeter* was damaged and forced to retire to Surabaya. Of the Allied destroyers, three were sunk and the remainder returned to Surabaya. In an action that night the Dutch cruisers *De Ruyter* and *Java* were sunk, leaving H.M.A.S. *Perth* and U.S.S. *Houston* remaining of the Allied force. They were undamaged, and proceeded to Batavia. They left there again on the night of the 28th February after refuelling, and soon sighted a large enemy force north of Sunda Strait. *Houston* was hit and took fire; *Perth* was also hit and, all ammunition being expended, the order "abandon ship" was given.

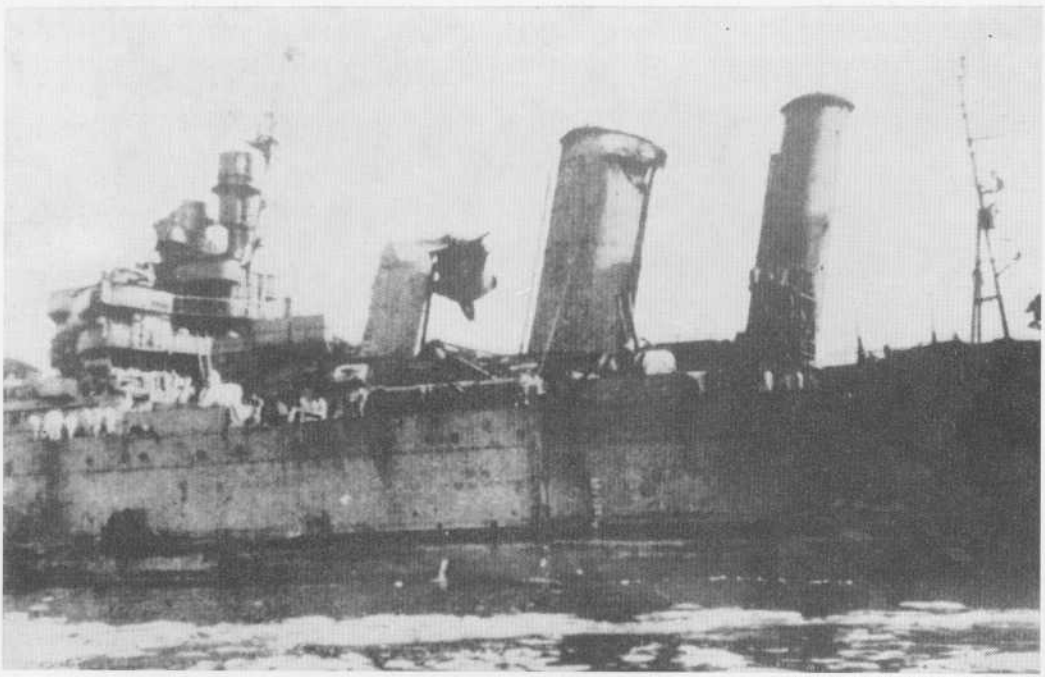
Severe damage continued to be inflicted on *Perth* after the order to abandon ship. The forward medical station was still receiving patients at the time, but the sick bay had been wrecked by a shell. Further torpedo hits caused damage and casualties on the after part of the ship. Stening, who was there, supervised the complete evacuation of the after part below decks. The quarterdeck was crowded with some 100 men trying to put rafts and floats over the side. Damage to the superstructure blocked access to the forward part of the ship, and Stening, after attempting to go forward, returned to the quarterdeck. All the men had now gone overboard, and he himself dropped off the stern just as a torpedo hit the quarterdeck. Many men in the water must have been killed by blast. Stening, suffering from concussion, was pulled on to a punt with three others. During the night this party met many men floating on rafts or wreckage and some swimming, to whom they gave a rest on the punt by getting into the water themselves.

Dawn showed survivors floating over a wide expanse of water. Some of them, apparently overwhelmed by the strong current, disappeared. A Japanese destroyer took on board all who could reach her side, including Stening and the party on the punt with him. These survivors were suffering from exhaustion, and from the irritant and nauseating effects of the thick fuel oil which floated an inch deep on the water near the place where the ship sank. Their eyes, nose and mouth, particularly their eyes, were inflamed and painful for some time. They were given water and a loin-cloth in exchange for their oil-soaked garments, and a Japanese orderly washed out their eyes and dressed the wounds of some of them; others had traces of oil in wounds or in their hair for weeks afterwards.



(D. Salter)

A British destroyer removing troops from the sinking *Costa Rica,* after an attack by German bombers, 27th April 1941.

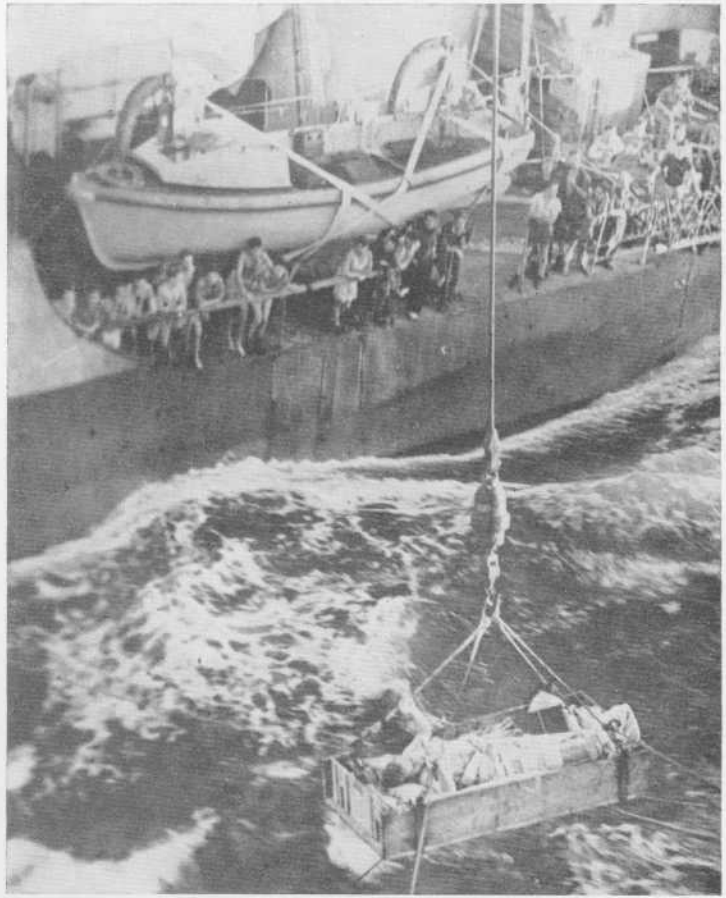


(Australian War Memorial)

H.M.A.S. *Australia,* showing damage from *kamikaze* attacks in Leyte Gulf, October 1944.



(*R.A.N.*)



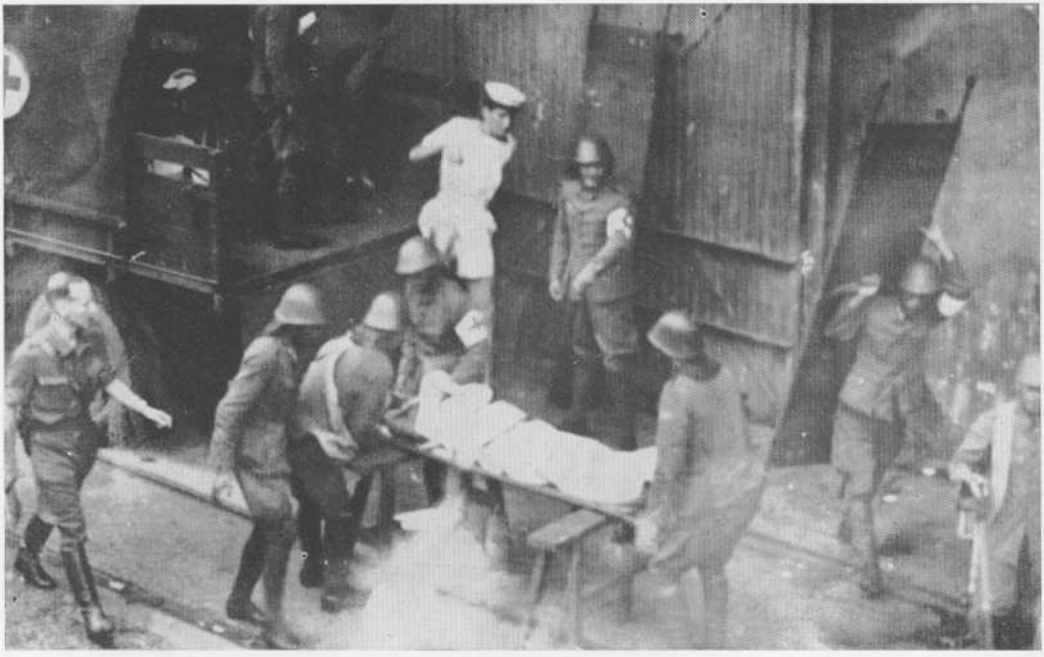
(*R.A.N.*)

Transferring casualties at sea. On the left an invalid on a Neil Robertson stretcher is being hoisted on board H.M.A.S. *Westralia* during the evacuation of civilians from Nauru Island, July 1941.



(*L. Lockwood*)

Surgeon Commander L. Lockwood and S.B.A. B. Phillips attending to wounded being transferred to *Hobart* from *Norah Moller,* sunk in Banka Strait, 3rd February 1942.



Wounded from *Norah Moller* being carried ashore from *Hobart* at Batavia, 4th February 1942.



(*R.A.N.*)

X-ray department, naval base hospital, Milne Bay.



(*R.A.N.*)

Rest hut at the naval base hospital, Milne Bay, 1944.

Other survivors from *Perth* reached Java and Sumatra, but none escaped. Some died from their wounds, others were murdered by hostile natives, and the rest became prisoners of war. The experiences of those of *Perth's* crew who became prisoners are described in the following chapter.

It was now obvious that Java would have to be evacuated, and this operation was completed by 2nd March. The seven corvettes were dispatched to Australia, where they arrived safely between 8th and 10th March. *Yarra,* which was escorting two naval auxiliaries and a small minesweeper, was less fortunate. On 4th March these ships were met by a Japanese force consisting of three cruisers and two destroyers. *Yarra* gallantly laid down a smoke screen and attempted to engage the enemy, but, outranged and outgunned, was destroyed along with her three helpless charges. There were some survivors from the ships of the convoy, and 34 of the 152 men on board *Yarra* got away on two rafts, but only 13 of these survived. They were picked up by the Dutch submarine *K 11* and taken to Colombo.

Meanwhile the Japanese had made their first attack on the Australian mainland. On the morning of the 19th February 1942 Japanese aircraft attacked Darwin, causing serious damage and casualties. American aircraft which tried to take off were shot down before they could gain altitude, and four of five others patrolling over the harbour suffered the same fate. The Japanese then systematically bombed shipping in the harbour, destroying five merchant ships, and damaging others. The U.S. destroyer *Peary* was caught by the bombers before she could make the open sea and was sunk, her guns firing gallantly to the last. The only R.A.N. ships lost were the lugger *Mavie* and the coal hulk *Kelat*. *Swan* and *Platypus* were damaged. In *Swan* an ammunition locker exploded and a number of men, who unfortunately were wearing only shorts and shoes, sustained burns. Those wounded on the deck were given attention there and then carried or assisted below, where they were wrapped in unlashed hammocks as some protection against bomb splinters which penetrated the side of the ship. The hospital ship *Manunda* was also hit and there were casualties aboard, but the ship itself was not seriously damaged.

The medical staff present at the Darwin civil hospital at the time included the Chief Medical Officer, Dr W. B. Kirkland; the Senior Medical Officer, Dr R. Catalano; the Junior Medical Officer, Dr J. R. R. Taylor; Surgeon Commander C. H. R. James, S.M.O. H.M.A.S. *Melville,* and Surgeon Lieutenant L. A. Hardy, M.O. H.M.A.S. *Swan.* The sick-berth staff were under S.B.P.O. Mackenzie. Female nursing staff, under charge of the matron, included trained sisters and trainee nurses of Darwin hospital. The following brief naval medical account of the raid is based on the report of Surgeon Commander James to the D.N.M.S.

From 9.45 to 10.30 a.m. on 19th February planes were heard at the civil hospital, followed by gunfire and explosions. No sirens were heard. There were 34 patients in the main naval ward, and they were ordered to lie beneath their beds, leaving the mattresses above them; those

unable to comply were helped or lifted beneath the beds. A heavy explosion occurred while this order was being carried out; stones, glass and other debris were thrown about and the buildings shook; No. 2 naval ward was largely wrecked and No. 1 naval ward damaged; outbuildings were also damaged. The civil ward and X-ray room were affected, as were part of the administration building, and the kitchen and staff quarters. The electrical and hot water systems were put out of action, but otherwise the theatres were not harmed. There was no serious injury to patients. Dr Kirkland and Surgeon Commander James determined the order of priority for surgical attention, as casualties began to arrive within a few minutes of the fall of the bombs near the hospital. One operation was performed, but another raid decided the medical staff, on the score of safety, to postpone further operating if possible. Resuscitation and arrest of bleeding were carried out, and morphine given where necessary. An army operating team expected for the second theatre failed to arrive, but a naval dental officer was available for anaesthetics, and in the afternoon surgical work was resumed. The strain on the staff, which was considerable, was relieved by the arrival of four nurses from the 119th A.G.H. whose assistance had been urgently requested. Under emergency conditions theatre work continued till after midnight. Numbers of casualties were also treated at the *Melville* sick bay, which was manned continuously.

In the small hours of the 20th the Assistant Director of Medical Services of the 7th Military District arrived at the civil hospital and, as information had been received that Larrakeyah military barracks would be bombed next day, instructed that all patients should be evacuated to the Berrimah hospital. Surgeon Commander James assented very unwillingly, as he thought it unwise to move patients who had suffered such recent injuries. About 300 civilian and service casualties were sent to Berrimah, and with them Surgeon Lieutenant J. A. James of *Melville,* sick-berth staff and nurses from the R.A.N. and Darwin civil hospital. Commander James and Dr Kirkland remained to deal with a constant stream of walking wounded. It was considered that, in view of crowded conditions and the lack of surgical facilities at Berrimah, all wounded and ineffectives there should be placed on board *Manunda* and sent to Fremantle. This advice was given to the Naval Officer-in-Charge, Darwin, who authorised *Manunda* to load and sail.

At the naval wharf an urgent duty had to be discharged: the disposal of the decomposing bodies of dead piled under the signal station. As shore burial was impossible, Surgeon Commander James had the bodies placed on a barge in charge of a warrant officer who took the barge out to sea, where the bodies were committed to the deep. Then all sick and wounded were loaded on *Manunda.* It was decided that the ship's own medical staff would be adequate without further assistance, and that the vessel would sail with lights after notifying the Japanese of the intended course, in accordance with the Geneva Convention.

The outstanding work carried out by the civil hospital and the *Manunda* during and immediately after the raid was continued, and *Manunda,* though damaged by bombs, reached Fremantle safely.

Dr Kirkland, in a brief description of the raid, pointed out that the attacks were concentrated on shipping, the wharf and airfields, and that only two sticks fell in other areas, the post office area and near the civil hospital. Most of the casualties occurred on ships and the wharf. There was a preponderance of wounds of the limbs over those on head and trunk, and tissue damage was in many cases considerable. Several amputations were necessary. A number of persons were killed and injured by blast, and numbers died later from this cause. Blast injuries were also received by men submerged in water. Twenty-three persons were killed in one shelter trench by a direct hit. It was found that some of the A.R.P. workers attempted too much first-aid treatment, and it was suggested that the limitations imposed by circumstances and by shock should be firmly impressed on them. Casualties of the raid were 238 killed, including 12 who died of wounds on the *Manunda*; some 320 were injured.

H.M.A.S. *Swan's* medical officer, Surgeon Lieutenant Hardy, in reviewing the action, recalled that many ratings were not wearing their identification discs when injured, an omission which would have created serious difficulties were it not for the fact that the sick-berth attendant on duty on deck knew each man personally. As well as the necessity for wearing identification discs at all times, the raid emphasised the importance of having adequate numbers of ratings trained in first aid and of splitting up the medical party. Subsequently 12 first-aid haversacks were placed at vital points in the ship. In addition to their usual contents, these contained loose cotton wool for use as ear plugs and lengths of rubber for tourniquets, improvised from the inner tubes of bicycles.

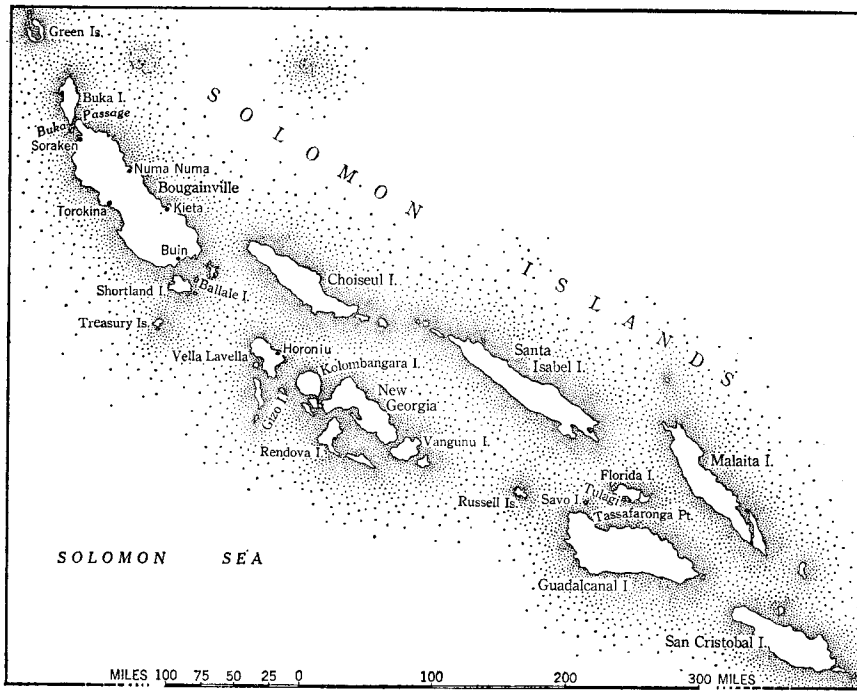
Another reverse was suffered in April when H.M.A.S. *Vampire,* acting as escort to H.M.S. *Hermes,* was attacked by aircraft in the Bay of Bengal and sunk. Six members of her crew were killed; three died later and one was presumed dead. The British hospital ship *Vita* picked up survivors from the water, many of them injured. Wounds included fractures, multiple lacerations, shrapnel wounds and burns with consequent shock. Many also suffered from contact with fuel oil, and had the chemical conjunctivitis and gastro-enteritis common to that type of casualty.

The Japanese, inspired by their successes, were now driving farther southward. Their drive was halted at the Battle of the Coral Sea, fought on 5th-8th May, when their attempt to capture Port Moresby from the sea was thwarted.

The fact that Australia was in the front line of battle was brought home when the Japanese on the night of 31st May-1st June made a daring but abortive raid on Sydney Harbour with midget submarines. Three submarines made the attempt, and all were destroyed, owing in a large measure to the vigilance of the Naval Auxiliary Patrol. Apart from the naval depot ship *Kuttabul,* a former Sydney ferry which was sunk, the

only ship damaged was the Dutch submarine *K9*. Twenty-one naval ratings in the *Kuttabul* were killed.

Two months later an Allied force, which was largely American but which included an Australian cruiser squadron, comprising *Australia* (Captain H. B. Farncomb), *Canberra* (Captain F. E. Getting) and *Hobart* (Captain H. A. Showers) under the command of Rear-Admiral V. A. C. Crutchley, V.C., embarked on the recapture of Guadalcanal



and Tulagi in the Solomons. Successful landings were made on the islands by American marines on 7th-8th August, and attacks by land-based aircraft were repulsed, at least 18 enemy planes being shot down. However, about 1.45 a.m. on the morning of 9th August, an enemy force of seven cruisers and one destroyer attacked the Allied ships protecting the transports and supply ships. The Allied cruisers, *Canberra, Quincy, Vincennes* and *Astoria* were all sunk and *Chicago* was damaged.

The night action in which *Canberra* was sunk was fought under the most adverse conditions from the medical point of view. Early damage to the cruiser imposed great difficulties on the medical parties, which had been working in closed stations for three days. A few minutes after the sounding of an alarm a loud explosion occurred in the sick-bay flat. The first severe casualty appeared at once, a rating whose arm was shot away, and hardly had a tourniquet been applied and morphine given when

the lights went out, and the water-supply failed. The ship listed badly to starboard; fires broke out in several places, and the sick bay became untenable, making it necessary to move the wounded to the forecastle where, in constant heavy rain, they had to remain for several hours. Medical personnel carried on in three sections. A forward party, situated in a mess deck, was in charge of a surgeon lieutenant, and included a sick-berth attendant and four first-aid ratings. A sick-bay party was composed of the surgeon commander, one sick-berth petty officer, one leading sick-berth attendant and six first-aid ratings. An after party consisting of one chief sick-berth petty officer, two sick-berth attendants and three first-aid ratings worked in the wardroom, which was fitted as an emergency theatre and equipped for giving transfusions of serum. Each party had its own equipment, which was fortunate as the forward and after parties were completely cut off. In addition small first-aid kits and tourniquets were distributed to all parts of the ship. The surgeon commander of U.S.S. *Chicago* supplied twelve officers with morphine "syrettes", though in the stress of action these did not function well. Work was maintained at a constant pitch for three hours, after which the U.S. destroyer *Patterson* began to take off casualties. Surgeon Commander C. A. Downward and Surgeon Lieutenant K. N. Morris from *Canberra* went across to *Patterson* with the wounded to supply badly needed surgical attention. The transfer of wounded was interrupted at 4.30 a.m. by the reported approach of a hostile ship, and *Patterson* broke away. The hostile ship proved to be *Chicago* and after exchanging gunfire with each other she and *Patterson* returned about 6 a.m. accompanied by U.S.S. *Blue*. This ship removed 49 patients from the forecastle and quarterdeck of *Canberra* and transferred them to the American transport *Fuller* and soon afterwards *Blue* took off the remaining casualties, and also Surgeon Lieutenant D. A. Warden of *Canberra*.

Surgeon Lieutenant W. H. Milroy of *Hobart,* with three sick-berth attendants, was sent across to *Fuller* to give assistance. Just as they were boarding the transport across an American destroyer which was transferring survivors from *Canberra* an air raid warning was sounded. Most of the survivors were still crowded on the destroyer's deck, but in spite of a natural hastening towards the transport, the transfer was made in an orderly fashion, and both ships got quickly under way. On the transport there were some 35 seriously wounded and a few lightly wounded men. The medical party from *Hobart* and *Fuller's* medical staff cooperated in their treatment, which in the early stages consisted of application of splints, cleaning wounds and lightly packing with sulphanilamide powder, arrest of bleeding, and closing "sucking" chest wounds. Plasma was administered to fifteen shocked men. This work continued until the early afternoon and was facilitated by the excellent and generous equipment of the American ship. Two more American surgeons then arrived and the *Hobart* party returned to their ship.

U.S.S. *Barnett* was able to take 64 casualties from *Canberra,* including Captain Getting who was severely wounded and who died the day after

the action. At one stage *Barnett* was holding 200 casualties from the two ships, and a total of 677 survivors from *Canberra,* wounded or fit, and was supplying two active surgical teams, one American and one Australian, which were both hard at work when *Canberra* sank.

The final arrangements for collecting and transferring casualties worked smoothly. Preliminary surgical work was complete within two days, and at the end of five days the Australian bed-patients were safely aboard the American hospital ship *Solace. President Grant* took care of all other survivors, both wounded and unwounded.

Milroy in his report drew special attention to the value of adequate doses of morphine and of plasma transfusions. He also noted the great relief afforded to "sucking" chest wounds by closing them, and the importance of early operation in all abdominal wounds and abdominal blast injuries.

The three sick-berth attendants who accompanied Milroy were S.B.A's J. P. Ryan, R. Joselin and A. Furniss. S.B.A. Ryan reported that on arriving on board *Fuller* they discovered the injured to be in cabins on the starboard side.

> We set to to cut away their clothing and wash and dress their wounds. There were quite a few serious cases amongst them and we attended to these first. There were no burn cases among the injured. I was surprised as I thought there would be a lot of them, but the injuries consisted mainly of shrapnel wounds. In some of the cabins there were a lot of shock cases; they all seemed to be in good spirits and laughed and joked with me as I dressed their wounds. I was parted from the other sick-berth staff and went with Surgeon Lieutenant Milroy to one of the other cabins, where there were two American sick-berth ratings. Among the patients were a midshipman with his back full of small pieces of steel—it appeared as if someone had fired a charge of buckshot at him—a rating with a fractured femur, and another with an injury to his lung. We assisted Surgeon Lieutenant Milroy in five or six blood transfusions and the same number of Thomas splints were applied. The American S.B.A's were good workmates.
>
> On all cases we attended sulphanilamide powder was used with an atomiser, the powder being blown into all parts of the wound.

S.B.A. Joselin also commented on the fact that few cases of burns were encountered, adding that it was probably due to the absence of bombing. S.B.A. Furniss reported that between the three of them they attended to about 25 wounded, and that the greater number of wounds were from shrapnel.

Surgeon Commander Downward's report emphasised the need for adequate dosage of morphine. Morphine administration was not easy under action conditions. The "syrettes" issued to non-medical officers were not of much value, partly because the officers were too busy with their normal duties to use them, and partly because the outfits had certain defects: the stylets sometimes bent, and would not pierce the tubing, and the needles were blunt. "Tubunic" outfits were more complicated, and their manipulation in poor or little light was difficult.

Intravenous anaesthetics were invaluable, in view of the large number of casualties which had to be attended to in a short time. Downward

also emphasised the value of having a number of sub-divided stores of medical equipment, and an ample supply of stretchers, both of the wire and Neil Robertson type, and of Thomas splints. The most useful first-aid outfit was found to be one contained in a canvas bag with all items for dressings, including pads, antiseptics, triple dye, tourniquets and a pair of scissors. The distribution of tourniquets was particularly successful; these were made after the St John Ambulance pattern by the ship's sail-maker, and were used by many of the ship's company instructed in first aid. The urgent necessity for a method of secondary lighting superior to oil lamps was apparent: Downward thought that a torch with head adjustment was the best method, and recommended that this should be supplied to all members of first-aid parties.

Routine methods were adopted for first treatment of gunshot wounds. *Débridement* under general anaesthesia was practised, followed by a spray of sulphathiazole and dressing. Deep wounds were given a light packing of sterile vaseline gauze and splinted with plaster. Steinmann's pins were inserted if extension was indicated. Sulphonamides by mouth were continued and results were very good. The need for generous supplies of tableted and powdered sulphonamide preparations was emphasised.

Surgeon Captain W. J. Carr, the Director of Naval Medical Services, in his comments pointed out that supplies of morphine in self-giving outfits were hard to procure, and that sulphonamides were scarce in Australia. Fuller supplies of the latter were acquired after this action and a scale of ½ lb per 100 men was proposed.

The naval struggle between Americans and Japanese was to continue for some months before the Japanese were finally defeated in their attempt to recapture Guadalcanal. The final naval engagement in the campaign was the Battle of Tassafaronga, fought on 30th November, but the Japanese did not withdraw from Guadalcanal until February 1943.

In the Indian Ocean the British had landed a force on Madagascar, and by September 1942 had brought the whole of the island under their control. A large naval force was engaged in the operation, and Australia was represented by the destroyers *Napier, Nizam* and *Norman.* The two first-named, and *Nestor,* joined the Eastern Fleet at the beginning of 1942, and *Norman* joined in February of that year. In June the four Australian destroyers had been part of the forces temporarily transferred from the Indian Ocean to the Mediterranean to support the passage of important convoys from the east and west to Malta. During these operations a cruiser, five destroyers and six merchant ships were sunk by air and submarine attacks. *Nestor* was one of the destroyers lost. She was seriously damaged by torpedo-bomber attack at dusk on 15th June off the south-west corner of Crete and had to be scuttled when in a sinking condition next day. Four ratings were killed.

In December 1942 H.M.A.S. *Adelaide* with a Dutch warship intercepted the German blockade runner *Ramses* in the Indian Ocean. When challenged the Germans scuttled their ship.

To the east in the Arafura Sea H.M.A.S. *Armidale* was lost to air attack in December, while on her way to Timor with guerilla reinforcements. Only 43 of her complement survived; 40 R.A.N. personnel and 60 Dutch troops were lost.

Two new destroyers, *Quiberon* and *Quickmatch,* were added to Australia's navy in 1942. In November 1942 when Allied forces landed at several points in North Africa, the R.A.N. was represented by *Quiberon,* which was included in a British force which destroyed an enemy convoy trying to reinforce Tunis. A British destroyer, in company with *Quiberon,* was torpedoed. *Quiberon* went alongside and removed her complement, narrowly escaping destruction by bombing as she did so.

From North Africa the victorious Allies crossed the sea to Sicily and on 3rd September 1943 landed on the Italian mainland. Six days later Italy surrendered unconditionally. During a period of nearly four years of war in the Mediterranean Australia was continuously represented either by ships or by personnel serving in ships of the Royal Navy.

Meanwhile in the Far Eastern theatre the struggle for control of the South-West Pacific continued. In the New Guinea area Australia established an advanced operational base at Milne Bay. The Japanese were well aware of its strategic importance, and in August 1942 attempted to gain a foothold. This time they underestimated the strength of the Australian force, and were eventually thrown back with heavy losses. Japanese naval units proceeded to evacuate their forces and on the night of 6th September a Japanese cruiser which had come to the bay for this purpose sank the motor vessel *Anshun* which was lying off Gili Gili. The hospital ship *Manunda* was anchored near by: she was brightly lit, and the Japanese after an inspection by searchlight withdrew without attacking. The following night another Japanese cruiser came to the bay, and again the immunity of the hospital ship was respected.

It was from Milne Bay that the smaller units of the R.A.N., particularly the minesweepers commanded and manned largely by R.A.N.R. personnel, assisted the Allied advance along the north coast of New Guinea. They were preceded by the R.A.N. survey ships, which carried out their work of mapping uncharted waters frequently under the eyes, and sometimes under the fire, of the Japanese. For the assault on the Japanese at Buna, men and supplies, including tanks and artillery, had to be taken by sea to Oro Bay by a hitherto unsurveyed route. H.M.A. ships *Polaris* and *Stella,* and later *Whyalla,* undertook the work. They were frequently bombed, and often had to take cover in the mangroves, which led to a malarial rate in the crews which was inordinately high for sea-going personnel. The work was completed successfully, and troops were transported from Milne Bay to Oro Bay, mostly in Dutch ships escorted by H.M.A. corvettes.

In a campaign off the east coast of Australia which lasted from May to August 1942 Japanese submarines sank eight ships and damaged three. The campaign was resumed in January 1943 with the sinking of the freighter *Kalingo,* and culminated in the sinking of the *Portmar* on 16th

June. On 14th May 1943 the hospital ship *Centaur,* while en route from Sydney to New Guinea to embark wounded, was torpedoed by a submarine 40 miles east of Brisbane. Of her total complement of 332, which included medical personnel and nurses, only 64 survived. The *Centaur* was marked with the Red Cross and was fully illuminated, complying in every way with the provisions of the Geneva Convention. Between June 1942 and June 1943 19 ships were sunk in Australian coastal waters by Japanese submarines.

After the Japanese had been defeated in Papua they made an unsuccessful attempt to capture Wau. This was followed by months of hard fighting round Salamaua. In September 1943 a two-pronged Allied offensive against Lae opened, with the 7th and 9th Australian Divisions playing the leading part. In that month the 9th Division arrived at Milne Bay aboard H.M.A.S's *Manoora* and *Westralia,* preparatory to an assault landing near Lae. *Manoora, Westralia* and *Kanimbla,* as mentioned previously, had been converted to Landing Ships Infantry earlier in the year. Surgeon Commander R. F. Matters of *Manoora* reported that before going to New Guinea he attended a malarial school at Cairns.

The instructions given were that all sailors and ships' personnel were to wear long-sleeved shirts and trousers with boots and gaiters (he wrote). Each man was to have mosquito repellent, and each man was to have one tablet of atebrin per diem. As *Manoora* at times carried 1,500 to 2,000 U.S. troops, the U.S. medical stores organisation provided 20,000 tablets of atebrin, also quantities of quinine sulphate, sulphadiazine, sulphaguanidine, 5,000 salt tablets, numerous syringes and a quantity of catgut.

Captain C. C. Baldwin of *Manoora* made a signal when the ship left for New Guinea that medical officers should begin to distribute atebrin to the hands. *Manoora* did not have one recorded case of malaria, nor did *Kanimbla* at that time. *Westralia* decided to rely on long sleeves and covering exposed areas, and later it was found that *Westralia* had over half a dozen cases of malaria, two of which were critical with malignant malaria.

Manoora had over 2,000 men on board, including a large number of U.S. troops, but the water-supply was restricted. There were many gallons of fresh water in the double bottoms, and Matters requested that this be used. The Engineer Commander said that the water would have to be replaced with salt water, which might produce a little salt in the drinking water. This, as was pointed out, would not be without value in those latitudes. The importance of taking on board supplies of fresh water was strongly emphasised, especially as ratings were showing signs of skin diseases. As a result of Matters' representations, fresh water was obtained from Goodenough Island, and the fresh water tanks were filled after the R.A.A.F. pathologist had pronounced the water perfect.

The landing near Lae was successful. Salamaua fell on 11th September, and Lae was captured on the 16th.

After Lae, the coastwise advance proceeded to Finschhafen, which was occupied by troops of the 9th Division on the 2nd October. American troops landed at Saidor on 2nd January 1944, *Arunta* and *Warramunga* being included in the covering force. American landings were made at

Hollandia and Aitape on 22nd April, *Westralia, Manoora* and *Kanimbla* taking part, escorted by *Australia, Shropshire, Arunta* and *Warramunga.*

In New Britain also the Allies had pursued the offensive. Landings were made at Arawe and Cape Gloucester in December. Present in the New Britain area at different times, carrying troops, covering the landings, performing patrol and escort duties were H.M.A.S's *Australia, Shropshire, Arunta, Warramunga* and *Westralia,* also the smaller ships *Vendetta, Barcoo, Swan, Burdekin, Cootamundra, Dubbo, Kiama, Lithgow, Diamantina* and *Shepparton.*

In February 1944 American landings were made in the Admiralty Islands; H.M.A.S. *Benalla* surveyed Seeadler Harbour during operations, and other R.A.N. ships assisted in the preliminary bombardment. Carrier-borne aircraft from the Eastern Fleet, which included R.A.N. destroyers, attacked Sabang Island off Sumatra in April and again in July, and on the second occasion Australian destroyers took part in a heavy bombardment.

In September American forces landed on Morotai Island in the Halmaheras and Peleliu in the Palau group. Included in the operations against Morotai was the Australian Squadron under the command of Commodore J. A. Collins. The possession of Morotai was of particular significance by reason of its position in the Halmahera group, and its suitability as a base for the long-awaited operations against the Philippines. By-passing Japanese positions in the Solomons, New Guinea and New Britain and the central and eastern Carolines, the Allies prepared to move on the Philippines. The Allied force consisted of the South-West Pacific forces under General MacArthur and Central Pacific forces under Admiral Nimitz, and included the Australian Squadron operating as a unit of the American Seventh Fleet.

The Australian Squadron comprised *Australia,* commanded by Captain E. F. V. Dechaineux, *Shropshire,* commanded by Captain C. A. G. Nicholls, R.N., and *Arunta* and *Warramunga,* commanded by Commander A. E. Buchanan, R.A.N., and by Lieut-Commander J. M. Alliston, R.N. *Shropshire* had arrived in Australian waters from the United Kingdom in September 1943. Other Australian ships taking part in this first Philippines action were the L.S.I. *Manoora, Westralia* and *Kanimbla,* and the survey ships *Gascoyne* and *Benalla.*

The great Allied convoy of battleships, carriers, cruisers, screening destroyers and transports sailed from Hollandia on 13th October 1944. Once in the open sea, the leading ships slowed, the destroyers adjusted the screen, and small craft formed up astern. Later, as the sun set, the convoy headed north into the darkness. Day by day the ships moved on, with mast-heads dotting the horizon, and covered by aircraft from the carriers astern.

Landings were made on Leyte Island on 20th October. *Australia* and *Shropshire* helped in the covering bombardment, which ranged from the 16-inch shells of the battleships to the smaller missiles of the destroyers and the attacking aircraft. Later in the day hostile troops were subjected to further fire. *Arunta* took part in this assault, which began in

the forenoon and covered the entrance of the landing ships and allowed the first wave of the amphibious vehicles to run in and establish a beachhead. Night fell on an impressive spectacle: Surgeon Lieutenant S. A. C. Watson of *Arunta* wrote of "ships, bombardments, bombings, strafings, landings, fire and smoke". Smoke was used chiefly to screen the ships against torpedo aircraft.

Next day a new weapon was added to the defence when enemy aircraft, probably flown by suicide pilots, termed *kamikaze* by the Japanese, severely damaged some of the ships. *Australia* was just beginning to move at dawn when a few Japanese planes appeared; one of them came in over the stern, flew very low along the port side and, perhaps out of control as a result of gunfire, carried on into the radar platform and director just astern of the bridge. The radar equipment fell on the bridge, and the plane struck the bridge superstructure and showered the bridge upper works with petrol before passing on over the forecastle and over the side. No bomb explosion occurred, but picric acid was later found scattered on the forecastle and the compass platform, probably derived from an unexploded bomb. The impact of the radar gear on the bridge produced a vivid sheet of flame, though the fires which started were quickly extinguished. It is curious that the medical party below noted the huge blaze but did not feel the impact either of the Japanese aircraft or of the crashed radar gear. The plane partly disintegrated before it disappeared, and many men were injured by metal fragments, as well as by burns and blast.

Captain Dechaineux, the commander of *Australia,* died of injuries. Commodore Collins was severely wounded, as was Commander J. F. Rayment. Total casualties were 30 killed or died of wounds and 66 other injured. A high proportion of the injuries were burns, usually multiple and very extensive. As mentioned, flying pieces of metal inflicted a number of wounds, and one officer died without showing definite external signs of injury, blast being the most likely explanation.

Facilities for medical work were seriously disrupted by the extent of the damage to the ship's structure. Four medical stations were used. The sick bay could take nine cot cases; the operating table, brought in from its usual stowage position outside, was set up and most of the surgical work was done there. Other emergency casualty rooms were prepared, one on the upper deck in the men's recreation room where there was good light, and another in the petty officers' mess on the main deck. The fourth action station was on the main deck aft. The staff of the sick bay consisted of the surgeon, three S.B.A's and 10 of the first-aid party trained by the medical officer for service in action. In general the sick bay, though equipped with good light and facilities for sterilisation, provided inadequate space, and the training of some of the staff was too sketchy to make for competence when major surgical work was being carried out. The after action station was in the charge of the Principal Medical Officer, Surgeon Commander J. M. Flattery, who had the assistance of three S.B.A's and 10 of the first-aid party. The latter were drawn

from cooks, stewards, writers and other ratings. In the wardroom near by there was provision for fixing an operating table, which was left in the alleyway when not in use.

The medical parties marked those casualties who in their opinion required urgent attention, and these were treated without delay. Identification of patients was in some instances difficult, so a cardboard tab was attached to each man as he was identified and all relevant details noted, such as the times of injections of morphia, plasma and penicillin. In some instances the initial injection of morphia was marked on patients' foreheads with indelible pencil.

The sick-berth staff worked incessantly from about 6 a.m. until midday when 15-minute spells were allowed to one rating at a time. By 7 p.m. each was given an hour off with instructions to spend the time on the upper deck, but it was not until about 2 o'clock the next morning that any real relaxation could be enjoyed. By this time the ship had cleared Leyte Gulf, so there was less risk of further casualties. At this stage medical personnel were strictly organised. One senior sick-berth rating was detailed to treat all patients with head and face burns and the rest of the sick-berth staff to assist medical officers in the treatment of other casualties. Some members of the medical party formed a hygiene squad and others attended to the nourishment of patients.

It was decided that *Australia* should proceed to Espiritu Santo for repairs and to transfer the wounded. It left on the day of the attack accompanied by the damaged American cruiser *Honolulu,* which at the start could only steam at 8 knots but soon got up to 14. Of the wounded 30 were regarded as serious cases requiring evacuation to a hospital ship. Unfortunately none was available, and it was necessary to retain them on board from 6 a.m. on the 21st October until the morning of the 27th. On the 22nd *Australia* met the U.S. hospital ship *Mercy,* which was going to Leyte. It was thought inadvisable to transfer the wounded, partly because of the bad effect it would have on them to be taken back to the battle area, and partly because the meeting took place in waters where there was danger of submarine attack, and transfer of patients would take some hours during which the ships would have to remain stationary. Two days later the hospital ship *Bountiful* was met, but the same reasons for not transferring the wounded prevailed. Five patients had died since the engagement, but only three remained on the seriously ill list. On 27th October during heavy rain 26 cot cases were landed at Manus and admitted to the American naval hospital. Next day 13 walking wounded were landed. There were no further deaths. The morale of the wounded was notable: many of them were desperately burnt, and, though the majority were very young, no complaints were heard. Opportunity was taken to obtain stores from an American store ship, and from the hospital ships *Mercy* and *Bountiful.*

The injured officers and ratings from *Australia* who had been transferred to the base hospital on Manus were later sent to Sydney in U.S.S. *Calamares.* Surgeon Lieutenant G. L. Grove was detached to accompany

them, as were four medical corpsmen from the base hospital. Surgeon Lieut-Commander Warden joined *Calamares* at Townsville, and was in charge of the party until its arrival in Sydney. The commanding officer and men in *Calamares* showed every consideration to the patients, and the abundant facilities of the ship were placed at their disposal. Help was also given by the R.A.N. shore establishment at Townsville, which supplied milk, and by the Red Cross, which sent on board supplies of fresh fruit and vegetables.

The necessary repairs to *Australia,* now under the command of Captain J. M. Armstrong, were effected at Espiritu Santo. *Shropshire* and *Arunta* remained with the Seventh Fleet, and took part in the action in Surigao Strait on 25th October, when two Japanese battleships were sunk. By 26th October the battle for Leyte Gulf had been won.

Australia rejoined the Seventh Fleet at Leyte after the completion of repairs, and was detailed to assist in the invasion of Luzon as part of the Australian Squadron, now commanded by Commodore Farncomb. *Manoora, Kanimbla, Westralia* and two ships of the Survey Group (*Gascoyne* and *Warrego*) were also detailed to take part in this action. The bombardment of the expected invasion point at Lingayen Gulf was timed for three days before 9th January 1945, the date set for the invasion. Leaving San Pedro Bay, Leyte, at midnight on the 2nd-3rd January, *Australia* and *Shropshire* proceeded via Surigao Strait to Lingayen Gulf, as units of a fire-support group.

On 4th January the American escort carrier *Ommaney Bay* was so severely damaged by a suicide dive bomber that it had to be sunk. In the late afternoon of 5th January about 120 miles west of Manila one of five Japanese aircraft passed *Australia* flying low. It was thought that it would go on but, making a steep turn, it dived upside-down on to the upper deck. A crane was knocked over, and anti-aircraft guns were put out of action. A bomb carried by the aircraft exploded and a petrol fire broke out. In all, 25 men were killed and 30 wounded.

The next day at about the same time *Australia* was again hit. Two of her 4-inch guns were put out of action, and the crew of one was killed as well as most of the crew of another. Later it was found that a bomb made from a large converted shell was used by this aircraft. A fire broke out, causing the temporary closing down of one boiler room. Fourteen men were killed and 26 wounded. Two days later, on 8th January early in the morning, two enemy planes attacked *Australia.* The first, swerving sharply, grazed the port side, but did no serious damage; the second was shot down nearly amidships just short of the ship. A bomb carried by the plane exploded and blew a hole in the ship's side 14 feet by 8 feet. There were no casualties, except as the result of shock suffered by some men on the upper deck.

Next day the landing was made, and once more *Australia* was hit by an aircraft. This came in from dead ahead, dived at the bridge, and missed it by inches. Scraping under the foreyard, it passed the bridge, and tipping one of the tripod mast struts, crashed into the forward

funnel, and after damaging it severely went over the side. Minor damage was also inflicted on the radar and some of the controls. There were no casualties. The bombardment by *Australia* had continued during these three dramatic days, during which there was no time even for the burial of the dead whose bodies were laid out on the forecastle.

Total casualties during the three days were 44 killed, including 10 who died almost immediately after injury, and 86 wounded. The fatal injuries were due to abdominal damage, shattering of a limb, severe chest wound and electrocution. There were not many general wounds; few men were injured by steel splinters and burns were less common than in the earlier attack, although they were usually very extensive. Penicillin was available and was given in 50,000-unit doses on the day of injury and repeated in all serious cases, especially those with compound fractures. One striking feature was the number of cases of "mental shock and action exhaustion". This condition appeared in some men immediately after action and in others after four to five days. The victims were among the best men in the ship. Common symptoms were pallor, weeping, trembling, convulsive attacks, vomiting, and loss of memory. Loss of memory, though impermanent, was occasionally complete: in one instance it lasted 11 days, and in another a recurrence took place after several weeks. Morphia in large doses and encouragement gave good results. The morale of medical personnel was tried severely during these operations. In common with the rest of the ship's company, they were at the first stage of readiness at dawn and dusk. This required them to be shut off at their stations with deadlights and watertight compartments closed, so that they knew nothing of what was going on. Of course, if there were casualties to be treated tension did not build up.

In these attacks, as in the Leyte action, wounded were collected into the stations promptly. Some difficulty arose in lowering them through the small trapdoors, which provided the only access to the main deck when the hatches were battened down during action. This manoeuvre was best performed when the patient was carried on a Neil Robertson stretcher or an ambulance stretcher, or by hand. The trapdoors could only be raised when this was safe, or when first-aid men were available. One Stokes litter was lent by the Americans and was found most useful.

After being hit for the fifth and last time *Australia* transferred 11 seriously wounded to *Manoora,* which acted as a troopship for the invasion forces, taking over cot and non-cot patients from the ships and the beaches. The usual method of transferring patients by means of the ship's crane could not be used, because the crane had been damaged by the first of the bombers. Instead, patients were put on a Stokes litter and lowered over the side, using the boats' davits. This was quite successful, except for the frequent interruptions caused by alerts.

When the most seriously wounded had been evacuated *Australia* left for Leyte. The rest of the patients did well on the voyage; many of them progressed sufficiently to be discharged to duty, and those who still required treatment were transferred to hospital ashore when they arrived

at Leyte on 12th January. *Arunta,* which had also suffered damage and casualties, arrived at the same time.

The campaign in the Philippines went ahead swiftly. Manila was entered by American troops on 3rd February, and Corregidor was subjected to a naval bombardment on the 16th, *Shropshire, Arunta* and *Warramunga* taking part, and ships of the Survey Group being there also. By the 28th Corregidor was clear of the enemy.

Reviewing the war before the House of Commons in September 1944, Mr Churchill had spoken of Britain's obligation to help to remove forever the Japanese menace to Australia and New Zealand, and of the large modern British fleet which had been promised to the United States for this purpose. In fulfilment of this promise the battleship *Howe* with escorting destroyers had arrived in Sydney in December 1944, followed in February by another battleship and four carriers with their attendant cruisers and destroyers. The Commander-in-Chief of the British Pacific Fleet was Admiral Sir Bruce Fraser. To provide dock and depot facilities and food for the British the Australian Government announced a £21,000,000 program.

On 1st April the Americans invaded Okinawa, and the British fleet, operating under the command of Admiral Chester Nimitz, cooperated. The British fleet, which included Australian destroyers and corvettes, was assigned the task of protecting the southern flank of the landing, which was done by a carrier strike against the Ryukus.

On 8th May Germany surrendered. President Truman warned the remaining Axis partner to "expect nothing but complete destruction unless you surrender unconditionally". Japan elected to fight on, and the drive against her was intensified.

The invasion of Borneo had been launched on 1st May. Australian troops landed at Tarakan, and Australian naval units were with the American units supplying the naval cover. H.M.A.S's *Hobart* and *Warramunga* provided support in the first operation with *Westralia, Manoora, Hawkesbury, Barcoo* and *Burdekin. Hobart* and *Arunta* with the three L.S.I. and *Lachlan, Barcoo, Hawkesbury* and *Glenelg* were present at the Brunei Bay landing on 10th June. *Shropshire,* which had had a refit, rejoined the squadron for the Balikpapan landing on 1st July. The three L.S.I. and the survey ships *Gascoyne* and *Warrego* were also there.

In the same month the Americans made further advances on Okinawa and in the Philippines, and the Australians in Bougainville and New Guinea. The Japanese home islands were the next objective, and the British Pacific Fleet cooperated with Admiral Halsey's Third Fleet in their bombardment. Tokyo had been subjected to a number of air strikes, and on 17th July a naval bombardment of the coastal area north-east of Tokyo was begun. On 6th August the first atomic bomb was dropped on Hiroshima and on the 9th another on Nagasaki. On 15th August hostilities ceased.

Through nearly six years of war the R.A.N., working in close cooperation with the Royal Navy, the United States Navy and the navies of the

Dutch and Free French, had helped to keep open the sea lines of communication between Australia and her allies. Ships of the R.A.N. fought in many areas: in the Mediterranean, in the Persian Gulf, the Red Sea, and the Atlantic, in the Indian Ocean and the Malay Archipelago, in the Pacific and the island campaigns and in the final operations in the Philippines. In addition, Australian personnel served in the Royal Navy. At the outbreak of war the Navy Board had offered to lend Australian personnel for service with the Royal Navy, and by June 1944 about 500 Australians were serving in the R.N., most of them belonging to the R.A.N.V.R. They served in every type of craft from battleships to landing craft, and took part in nearly every sphere of naval activity from the Russian convoys to the landings in North Africa, Sicily and Italy.

When hostilities ended, total deaths among R.A.N. personnel for the period of the war numbered 2,170 all ranks, all causes. In the war against Germany and Italy, 893 were killed in action or missing presumed dead, and in the war against Japan 949 were killed in action, missing presumed dead or died while prisoners of war. Accidental deaths numbered 100, 81 were drowned and 147 died from natural causes.



(*R.A.N.*)

Australian naval survivors from the Japanese transport *Rakuyo Maru*, being taken aboard the American submarine *Sealion* on the evening of 15th September 1944. The *Rakuyo Maru*, which was transporting about 1,200 British and Australian prisoners of war from Singapore to Japan, had been torpedoed by *Sealion* on 12th September.



(*R.A.N.*)

A critically ill prisoner of war from Ambon being disembarked at Morotai from H.M.A.S. *Junee*, September 1945.



(*R.A.N.*)

Dental inspection by Surgeon Lieutenant R. G. Willoughby on board H.M.A.S. *Vendetta* in Darwin Harbour, February 1943.



(*Australian War Memorial*)

Naval physiotherapist, Miss Nancy Towse, at work.

CHAPTER 7

PRISONERS OF WAR

THE number of men of the Royal Australian Navy taken prisoner was 381, including 39 officers and 342 ratings.[1] Of these some fell into Italian, some into Vichy French, and some into German hands, but the majority became prisoners of the Japanese. Their story, with the story of army and air force prisoners, is told in some detail in Volume II of this series.

The first men of the R.A.N. to become prisoners were Petty Officer H. Jones and Able Seamen W. J. Hurren and H. C. Sweeney from *Hobart*. On 9th August 1940 they were landed at Berbera, British Somaliland, with a 3-pounder Hotchkiss gun and 64 rounds of ammunition, and ordered to operate as an anti-tank crew against the advancing Italians. Six days later they were captured. They were released in April 1941, after the occupation of East Africa by British forces. Two other Australian ratings fell into Italian hands when they were rescued from the sea after H.M.S. *Hereward* had sunk off Crete on 29th May 1941. An officer, Lieutenant G. R. Worledge, was captured in Tobruk in 1942.

In March 1942 two Royal Navy motor launches (*ML. 129* and *ML. 132*) were attacked by Italian aircraft while on their way from Gibraltar to Malta, and *ML. 129* was sunk. The survivors, including two R.A.N. officers, were picked up by *ML. 132*, which put into Bone, Algiers, and requested 24 hours' sanctuary. This was refused and those on board were interned at a prison camp at Laghouat, French West Africa. Release came in November 1942, when Allied forces occupied Algiers.

The first Australian naval men to reach German prison camps were some D.E.M.S. gunners. On 20th November 1940 the British ship *Maimoa* was sunk in the Indian Ocean by the German raider *Pinguin*. The *Maimoa's* gunner, Able Seaman G. F. Cohen, was taken prisoner and sent to France on board the Norwegian tanker *Storstad*, which had been taken in prize in October. Landed with Cohen were Able Seamen D. T. Williamson, F. Allingham and F. S. Broad from the *Port Wellington*, another victim of *Pinguin*.

Twelve other D.E.M.S. personnel fell into German hands. They were from the *Nankin, Triadic, Australind, Afric Star, Speybank, Clan Cumming* and *Barneveld*. Eight of them were sent to German prison camps, and three from the *Nankin* to Japan. One from the *Triadic* was landed on Emirau Island with 500 other survivors from raided ships and was later rescued.

As well as D.E.M.S. personnel four officers and one rating were taken prisoner by the Germans. Two of the naval officers were captured during operations at St Nazaire in March 1942, another at Anzio in

[1] A civilian taking passage in an R.A.N. ship and a civilian canteen assistant and three R.A.A.F. personnel serving in *Perth* were also captured.

December 1943 and the fourth when the *Nankin,* in which he was taking passage, was sunk. The rating was captured in the European theatre in April 1942.

The first to return home was Able Seaman A. Appleby. He reached Fremantle in January 1944, having been repatriated on medical grounds. Another, Able Seaman Allingham, was released by the Russians at Odessa in March 1945 and the rest by American and British forces in April and May.

In German camps Red Cross parcels played a considerable part in maintaining health, particularly in the last months of the war when rations would otherwise have been inadequate. The majority of the Australian prisoners from these camps arrived home in good health; only two, both from the same camp, were repatriated suffering seriously from the effects of malnutrition; there were no deaths.

The greatest number of Australian naval prisoners was taken during the war in the Pacific. The first were Commander R. C. Creer and Able Seaman A. Warren, who were captured by the Japanese in Hong Kong in January 1942. Twenty-two officers (including three R.N. officers on loan) and 298 ratings (including three R.N.), members of the crew of *Perth,* were rescued from the sea or captured ashore in Java when their ship was sunk in Sunda Strait on 1st March 1942. One officer and 14 ratings were taken in the Malayan theatre. Eight coastwatchers, 5 officers and 3 ratings, were captured in New Britain and New Ireland, and one officer on special duties in Borneo. Two D.E.M.S. ratings and one officer were captured when the *Hauraki,* in which they were travelling, was taken in prize in the Indian Ocean by two Japanese armed merchant cruisers, and another officer while on an operational flight in an R.A.A.F. plane. As mentioned, the Japanese also held an officer and three ratings captured by the Germans.

A medical officer, Surgeon Lieutenant S. E. L. Stening, who was among the survivors of *Perth,* has described the experiences of some of those who were taken prisoner with him. About 240 men, including Stening, were picked up from the sea by destroyers and other ships and transferred later to the *Somedono Maru.* A Japanese army surgeon and two assistants arrived on board next day and, helped by Stening, attended to the wounded, removing shrapnel, dressing wounds, treating eyes damaged by fuel oil and resplinting a compound fracture of a leg. S.B.P.O. Cunningham, and S.B.A. Mitchell and P.O. Telegraphist Fowler also helped. The instruments and dressings provided were good and two days later additional small supplies of dressings were obtained, but thereafter nothing more was forthcoming. After a week the men in the *Somedono Maru* were transferred either to the civilian gaol or to the cinema at Serang in Java.

The prisoners arriving at the gaol were searched and their possessions taken away, including all the medical supplies and any food they had left. Until some prisoners were moved 550 men were confined in space meant

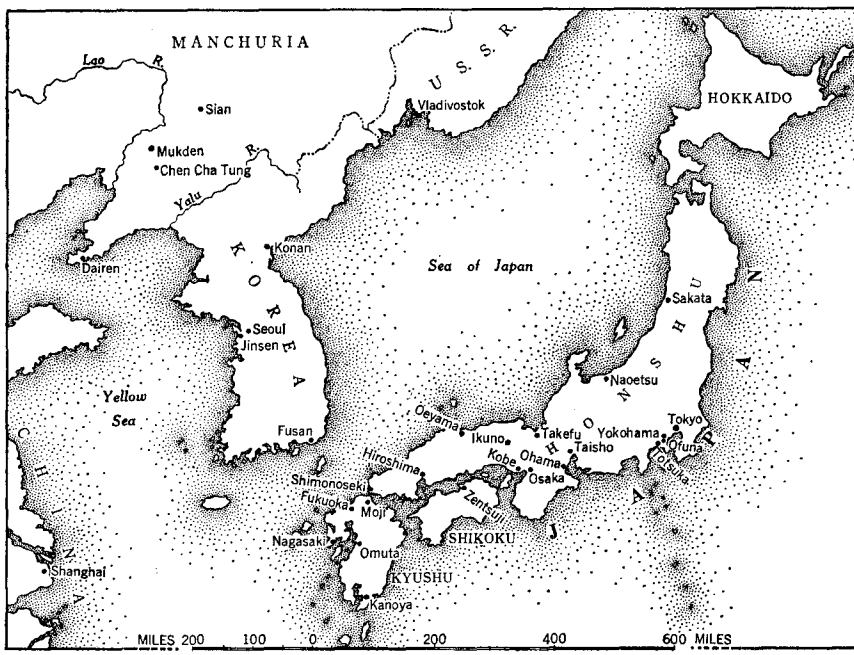
for 220. They had to sleep on bare concrete. Hygiene, when it existed at all, was of the most primitive form, and although orders were obtained for a minimum of sanitary precautions, it was almost impossible to ensure that they would be carried out. The average diet consisted of cold rice and a green vegetable and occasionally small pieces of fish or meat, with certain additions for the sick, which were obtained from Dutch internees. Cooking conditions were filthy. The galley was never cleaned and was traversed by a water channel used as a sewer. Permission was later given to construct an oven for baking bread and for two open ranges. Medical care was at first completely lacking. Then one day a Japanese army surgeon came and did some dressings—the first attention some of the prisoners had had. After an interval dressings were done for several days by a Chinese and a Javanese doctor. These local doctors also made a sincere effort to obtain any drugs and dressings which were requested. Lieutenant Burroughs, an American naval medical officer, was released from his cell to help, and for several days Stening too was allowed to help. Finally, Lieutenant Burroughs was ordered by the Japanese to attend to all the men in the gaol, and Stening the men in the cinema.

In the cinema were 600 prisoners, servicemen of different nationalities. They slept on bare floors, and used the seats as fuel for cooking. They had no water for washing, and no proper sanitary arrangements. Later a pit latrine was dug alongside the sleeping quarters, the only available space, near which the cooking and boiling of water were also done. Efforts to improve conditions failed at first because of lack of materials, but after a time field kitchens were erected. Stening saw at least 100 to 120 men at the daily muster. A Chinese doctor attended too, and C.P.O. Bland, a cook, gave invaluable assistance. Stening tried to arrange for all the sick to be sent to the local hospital. After some weeks he succeeded in having two transferred, but as they received no attention other than what could be given by two American cooks sent to prepare their food, their condition may have been worse than before.

Some of the men both at the gaol and in the cinema were suffering from severe injuries. One rating had a wound involving the posterior tibial artery: he was operated on successfully by an American medical officer with a Japanese army surgeon giving the anaesthetic. Other men had to submit to surgery without an anaesthetic and carried out with the only instruments available: a pair of scissors and a pair of forceps, both rusty. Under these conditions shrapnel was removed and a sequestrectomy performed. Men who were in the water when the already sinking *Perth* was struck by further torpedoes showed evidence of thoracic or abdominal blast. All but one recovered, but very few facilities existed for treating them or others who became ill while at Serang. Malaria was prevalent. As the only clothing many men possessed was a loin-cloth it was impossible for them to take precautions against the bites of mosquitoes, and while there was a small amount of quinine for treatment, none could be spared for prophylaxis. Dysentery and diarrhoea were also rife and, with only charcoal to treat them, soon reached epidemic proportions. There

were two deaths. Stening, who was at Serang for a month, recorded that there were no further deaths during his stay, despite the conditions.

On 5th April Stening with four other Australian officers from *Perth* and eight American officers were taken from Serang to Batavia, where they embarked in a Japanese transport for Japan. Conditions on board were far better than those at Serang and during the voyage the health of the prisoners improved considerably. They arrived at Moji on 5th May and went by train to Ofuna near Yokohama, an interrogation camp under naval control.



Prison camps in Japan. Most of the officers in Ofuna were from the Allied navies. They were informed that they did not rank as prisoners of war but as unarmed enemies. Food was satisfactory in quality, but deficient in quantity, and deficiency diseases, which appeared in the form of mild beri beri and scrotal dermatitis, were intensified by epidemic dysentery, proved to be a Flexner type. No effective measures were taken for prevention, and the advice of the medical officers among the prisoners was disregarded. The prisoners were subjected to great mental strain by long interrogations and by a prohibition against talking in the camp. The strain was heightened by the ever-present threat of violence; beatings were common, and for trifling offences public punishments were administered, even to convalescents. One of the amenities at Ofuna was the issue of months-old copies of the *Japan Times*. This allowed the prisoners to

follow world events from the Japanese standpoint, and gave them some insight into the Japanese mentality.

From Ofuna the five naval officers from *Perth* were taken to Zentsuji, the main prisoner-of-war camp in Japan from 1942 to 1943. It was designed as a model camp for officers. On arrival the prisoners were required, under duress, to sign an undertaking not to attempt escape, but apart from this there was no mental strain. It was permitted to send a radio message and to write letters, and some of the earlier inmates had already received mail. There was a library, a canteen, classes in a variety of subjects, deck tennis, a weekly walk through the countryside, and an area set aside for the rearing of rabbits. The diet, prepared by the prisoners' own cooks, was adequate for a sedentary life. The men who were working, mostly American sailors and marines from Guam, were given extra rations. At first captured clothing was issued periodically; later it was sold to officers. Red Cross comforts and foodstuffs were received at the camp, and a scanty distribution by the Japanese began. It was noticed that a number of men developed subcutaneous oedema soon after their arrival from Ofuna. However, this soon disappeared, presumably with a heightening of their metabolism due to improved diet. Some medical treatment was entrusted to officers of the U.S. Army Medical Corps, but Stening was not so engaged.

In November an emergency medical party was sent from Zentsuji to Moji to attend to the passengers of a Japanese transport, the *Singapore Maru,* which had just arrived from Java and Singapore. The unfortunate men on board, originally about 1,000, had been confined in insanitary holds for a month, without sufficient food; they had suffered a terrible outbreak of dysentery and over 90 had died. The medical party, consisting of 8 medical officers, one dental officer and about 30 medical orderlies, was divided into three groups, Stening being included in one under Lieut-Commander Moe, United States Navy. When this group arrived at the ship all the fit prisoners and the majority of the sick had been removed. The remainder were the very sick. Stening describes how they faced the major task of separating living from dead. "Down into this forward hold we gazed upon a filthy, odorous mass of rubbish, excreta, food, clothing and equipment amongst which we could see here and there a body which may or may not have been still living." One man there was not suffering from any illness but from complete exhaustion. He was Gunner C. W. Peacock, of the Royal Artillery. Single-handed, he had cared for, fed, comforted and nursed the sick men in the hold. Despite the bitterly cold weather, none of the sick had winter clothing, and the men of the medical party quickly covered them with their own warm overcoats.

The patients were then transferred by junk to the Shimonoseki quarantine station, where Moe's group looked after them for two months with the somewhat unwilling help of a few Japanese nurses attached to the station. The accommodation at Shimonoseki was adequate, the sanitation good, and the heating moderately so. Medical equipment and supplies, however, were scanty, and it was only by daily supplication of the Japanese

army doctor that Stening could obtain enough for their barest needs. For the first six weeks the prisoners were literally starving; in January 1943 their diet was supplemented by Red Cross food parcels, but by that time numbers of deaths had occurred. The shortage of winter clothing was relieved by distributing the clothes of the dead.

In March 1943 Moe's group was told that they were to move to Fukuoka No. 2 camp on Nagasaki Bay, where many men were dying, but on arriving they were not allowed to work for three weeks, by which time the urgent need for their services had passed. In the camp at the time were 1,260 officers and men from the Allied Services, including a medical officer from H.M.S. *Encounter* and three Dutch medical officers. The prisoners worked at the Kawanami shipyard, some on heavy labouring work and others on specialist tasks. Conditions on the whole were fair. As elsewhere, clothing and footwear were scarce, but food from being meagre became better and was supplemented by small numbers of Red Cross parcels; rest days, at first a rarity, were granted more readily later on. The amenities were good: a canteen was established; a fairly regular issue of cigarettes was maintained; there was the nucleus of a library; boxing gloves and playing cards were provided and, while no mail was received, all men sent several cards. Diarrhoea was the most prevalent disease, and some fatal cases of pneumonia occurred. There were also several cases of tuberculosis, mostly among British naval ratings. A few men had nasal and pharyngeal diphtheria. Skin diseases were common and difficult to cure. An aid post was maintained at the shipyard by Stening and a medical officer of the United States Navy. No safety precautions were taken by the Japanese; accidents were frequent, and many Japanese as well as prisoners were killed.

There was a slight disharmony between the Allied medical officers at this camp and it was with a feeling of relief that the 11 men of the medical group were ordered on 28th April to move to Fukuoka No. 14. This was a new camp, the building itself being a disused warehouse of the Mitsubishi Company. The inmates were 300 Dutch from Java. The work consisted of labouring at the Mitsubishi shipyards. While treatment at the camp was just and reasonable, at the shipyards harsh and bullying methods were used. Stening went there to establish an aid post, as at the Kawanami shipyard. The main illnesses of the prisoners were diarrhoea and dysentery, beri beri, painful feet, malaria, bronchitis and vitamin deficiency causing dimness of vision and skin affections; there was one case of coronary disease. Approximately 11 deaths occurred. After several weeks here Stening and two American Pharmacists' Mates returned to Fukuoka No. 2, where Stening became second-in-command of the medical department. They rejoined the rest of Lieut-Commander Moe's group when Moe left Fukuoka No. 14. Together they travelled to Moji, and there met the other two medical groups. All returned to Zentsuji on 6th July. Zentsuji was a changed camp. All the officers were doing some kind of work; the food ration had been cut progressively, and now all the men were very hungry and there was a general deterioration in health.

On 11th July Stening with Captain J. F. Akeroyd, A.A.M.C., and an American naval surgeon left for Osaka. Their destination was Itchioka Hospital, which was situated in part of the dressing rooms of the Itchioka sports stadium. There they were able to relieve Surgeon Lieutenant C. A. Jackson, R.N.V.R., who had established the hospital a year before with staff and patients from the survivors of the *Lisbon Maru,* which had been sunk off Shanghai. The patients were prisoners from camps in the Osaka area and included officers, other ranks and civilians of all nationalities. Though there were facilities for bathing, the buildings were verminous. Rations for the staff were inadequate, and the non-working allowances for the patients so grossly deficient that sick men clamoured to be allowed to return to their camps where at least they would not be starved. This situation was brought about by the systematic robbing of hospital rations by the Japanese. Protests only brought about an increase in the depredations, which also became more open. Punishments were frequent and administered sometimes for no reason at all. Surgeon Lieutenant Jackson's persistence in trying to improve conditions earned him many beatings. Numbers of seriously ill men were in this hospital, and in spite of all the efforts of the medical staff, the death rate was high. In the absence of any heating the winter cold distressed the patients, and 85 men suffering from the "painful feet" syndrome lost the skin of their toes by gangrene. Jackson had to stand by while some of these men were taken to the Japanese hospital and submitted to unskilful and unnecessary surgery by the Senior Medical Officer of the Osaka prison camps. Despite careful post-operative treatment by Jackson many died. The medical staff considered Itchioka from all points of view a disgrace to any country. The patients had to suffer such dreadful privations that many, no longer wishing to live, gave up the struggle.

From October 1943 to June 1944 Stening was the senior officer and the only Allied medical officer in Oeyama camp. This camp was on Honshu Island near a nickel mine, in which the inmates, clad in threadbare garments, carried out heavy work in rain and slush; when they returned to camp at night, wet to the skin, they had no change of clothing. One gang worked for more than a week up to the knees in icy water. Work bosses pushed the men to the limit of their endurance, and often the sick were forced to work, thus contributing to the death of many of them. Food though good at first soon fell off in quantity and quality. The lot of the workers was improved by the medical officer's decision to give them 360 grammes of grain ration daily, although this meant cutting down the ration of resting men to 250 grammes, plus what additions could be spared. These difficult conditions were lightened by the arrival of Red Cross food in December, almost a parcel to each man. However, the unaccustomed food, added to the extra food for Christmas supplied by the Japanese, upset many of the men. In March more Red Cross supplies arrived but most of those set aside for the sick were retained by the Japanese, who also kept some of the general supply for the camp until a successful appeal was made to the camp commandant.

In June 1944 the Japanese doctor produced a ration scale of 3,700 calories for workers and 3,400 for resting men. However, as most of the items on the scale were never received regularly, the actual figures were well below this. As hunger increased the men in the camp became more difficult to handle. They would steal from each other and from the Japanese and these latter thefts, if detected, led to severe punishments. In May 1944 Stening was empowered by the camp commandant to take control of the discipline of the camp and all the punishments. On the whole, this system worked well.

Hygiene was rigidly enforced by the prisoners' own administration. Notwithstanding, diarrhoea was rife: it frequently became chronic and was often a terminal event. As was to be expected, malnutrition was prevalent, particularly beri beri with or without oedema. Thoracic and abdominal effusions occurred, and often followed the administration of sulphonamides, even in a low dosage such as 1 gramme daily for two days. "Painful feet" resisted treatment, and skin affections, due to local conditions, were very common.

Taisho camp was also in the Osaka area. Stening was sent there in June 1944. Previously the medical care of the prisoners at Taisho had depended on a medical orderly, who in Stening's words had "worked and fought well for his patients". Some of the prisoners were doing labouring work and others more specialised tasks at the Osaka ironworks. Food was good at first but deteriorated when a new Japanese quartermaster was appointed. Red Cross food came in November and helped the men through the winter, while their diet was further supplemented by the products of their own garden. Another improvement was the provision by the Japanese camp staff of a midday meal for men who were working. Still malnutrition was rife in the camp, a predisposing cause being the prevalent diarrhoea. Beri beri of all kinds was common. At the time of Stening's arrival a Sergeant Nakate was the camp commandant, and the prisoners were treated well. When he was replaced by Sergeant Kakuia harsh and capricious treatment became the rule. All Japanese, including civilians, were given licence to indulge their sadism. Men were punished, often severely, for minor offences or for no offence at all. One man was stripped and made to stand in the open with the temperature below freezing point. A Japanese sergeant then threw buckets of water over him after first breaking the ice from the tops of the buckets. The sick were often ordered to work and appeals on their behalf by the medical officer were mostly disregarded. Conditions improved from November 1944, the improvement being coincident with the beginning of air raids over Honshu Island and especially over Osaka itself. Stening speaks of the never-to-be-forgotten sight of a flight of American heavy bombers over Osaka in broad daylight, and later of the big fire in Osaka, when incendiaries also rained on the camp. As the confidence of the Japanese was sapped, so the prisoners gained heart. Their food supply both legal and illicit increased, work decreased and the Japanese officers began to live at the camp. On 17th May the entire camp with the exception of

a few men who were sick or otherwise useless to the Japanese moved to Takefu about 70 miles to the north-east of Osaka.

From 17th May until the end of the war there were 167 Australians from Taisho and 33 Americans from Umida in Takefu. Surgeon Lieutenant Stening was the only medical officer there, and in fact the only officer. As was perhaps unavoidable in a camp of mixed nationalities, there was occasional friction. Work in the near-by carbide factory was heavy: there were many accidents and increasing numbers of men failed in health through being driven incessantly on inadequate rations. Though Red Cross food was in the store, it was not forthcoming when requested, and, in May, June and July 1945, the food ration was reduced; it was further depleted by the thefts of the Japanese camp staff. As at other camps, sick men were often forced to work. Intervention on their behalf by the medical officer was sometimes successful but more often led to a worsening of their plight.

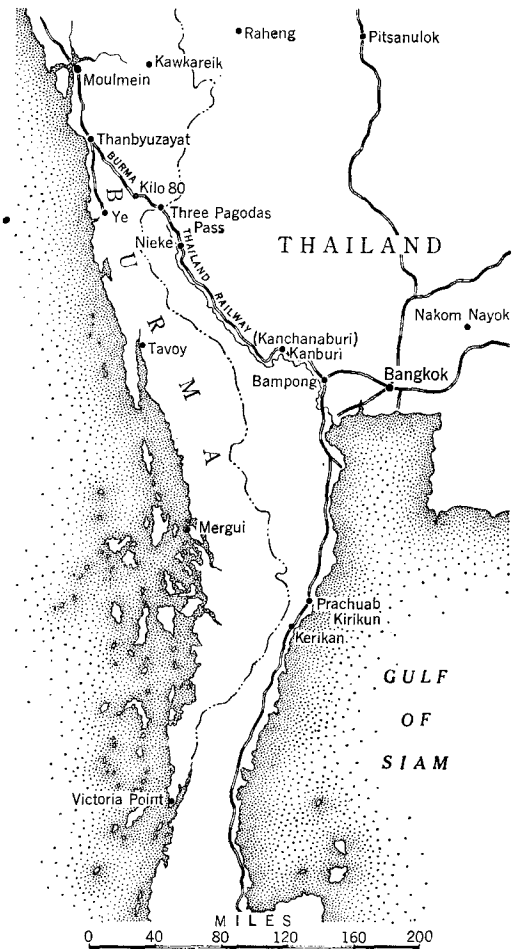
Punishments were frequent and Stening himself suffered many indignities. One barbarous form of punishment was popular with the Japanese. A man would be forced to kneel on bamboo with crossed feet; another bamboo would be placed behind his knees, and a 4-gallon can of water on his thighs, which he would have to hold still without spilling. This would continue for as long as an hour and a half. One man after suffering this punishment had to be carried back to camp, and was unable to walk for four hours. In one respect, however, Takefu was an improvement on other camps: once the prisoners had returned from work and had entered their sleeping quarters they were usually left alone. They did not suffer the mental strain of incessant intrusion by the Japanese looking for trouble and distributing punishments. There were few serious illnesses in this camp but skin diseases caused by the chemicals with which the men worked were prevalent. Some medical supplies were available having been brought surreptitiously from Taisho, and though the Japanese took Red Cross supplies to their quarters, they allowed modest requisitions to be filled, usually after furious argument.

On 15th August the men were given a holiday, and although the good news of surrender did not reach them for some days, they never returned to work.

Burma-Thailand Railway. The rest of the survivors from *Perth* left Serang in April 1942. They travelled by road to Batavia where they were lodged in the Dutch Military Barracks. In October most of them were shipped to Singapore and thence to Burma. A second party from *Perth* also left Java for Singapore in October. They embarked for Burma on 9th January in the *Moji Maru.* This ship and others in the convoy were attacked by Allied planes and many on board the *Moji Maru,* both prisoners and Japanese, were killed or wounded. Among the wounded were two ratings from *Perth,* both of whom died soon after reaching land.

In Burma the Japanese were forming a huge labour force from Australian, British, American and Dutch prisoners—members of the Services and civilians—and from coolie labourers for the purpose of building a

railway link between Burma and Thailand. The proposed starting-point of the line in Burma was Thanbyuzayat and the terminus in Thailand at Bampong. Construction was to begin at both ends of the line with a junction somewhere near Nieke. The 270-mile route covered stretches of dense, uncleared forest, and many tropical diseases were endemic to the area through which it passed. It had been surveyed by the British before the war, but abandoned because of its difficulties.



The prisoners were divided into national forces or groups. The first party of *Perth* survivors joined Williams Force (under Lieut-Colonel J. M. Williams of the A.I.F.) and the second party Group 5. Both began work on the Burma side of the railway. Another small party joined the forces working northwards from Bampong. With inadequate tools the prisoners had to clear dense undergrowth, fell giant trees, and later lay rails and sleepers. Their clothes, rotted by the climate, afforded them little protection against the elements or against injury; they lived in leaking huts or in the open; they were always hungry, and disease ravaged them.

The ration scale laid down by the Japanese consisted of rice, meat or dried fish, vegetables, salt, sugar and oil. The scale was never adhered to, either in quantity or in the issue of all the items included. The most serious shortage was meat: in the dry season the supply of cattle on the hoof was fairly regular but the beasts were very small and thin and produced no more than two ounces of meat per man. For long periods no fresh meat was supplied. Preserved meat in wooden boxes was sometimes issued but more often than not it was rotten and fly-blown. Nevertheless, any pieces not too far gone went into the pot. Vegetables varied

in quantity and quality and were rarely sufficient to make more than a thin soup to accompany the rice. From September to December the vegetable supply in Burma was poor, consisting in the main of marrows, local roots and half-rotten sweet potatoes. Oil and sugar were rare delicacies and there was hardly ever enough salt.

In 1944 Allied officers in Thailand were invited by the Japanese command to write frank essays on the conditions experienced in the construction of the Burma-Thailand railway. The essay on food took the form of a statement of the ration scale and a careful analysis of its food value, based on the assumption that all the items were, in fact, supplied and were of a reasonable quality. The analysis proved that the calorific value was insufficient for a man performing even light work; that there was insufficient carbohydrate in the rice, and that fat, protein and vitamins *A* and *B* complex were well below the necessary requirements. The Japanese scale was therefore below the needs of a man doing light work: the food actually supplied was below the scale and the work was heavy. The prisoners' kitchen did not receive the rations until the Japanese had taken what they wanted. For example, on one occasion when a small cow was slaughtered, the hindquarters went to the 30-odd Japanese and the rest to the 600 prisoners.

It is not surprising that large numbers of men on the railway were suffering from malnutrition, pellagra and beri beri, while many illnesses from other causes were aggravated by starvation. The Japanese attitude to the sick was curious. Paymaster Lieut-Commander R. F. M. Lowe of *Perth* wrote:

> The principle of the Japanese Army is that a sick man is a criminal and deserves punishment and not medical treatment. Throughout the whole of the railway construction period the supply of drugs and dressings was totally inadequate for the needs of the sick and injured. Quinine was usually plentiful but that was all. Many lives and limbs that were lost by tropical ulcers could have been saved if any means of treatment had been available. Amoebic dysentery took a terrible toll of life, yet with emetine they would have been saved. . . . In one respect only did the Japanese make any effort to maintain health and that was by frequent inoculations against cholera and plague.
>
> A direct cause of death and ill-health among the prisoners of war was the deliberate Japanese policy of sending sick men to work. As time passed, so the sick figures mounted and the numbers available for labour decreased. The Japanese remedy for this state of affairs was to call a parade of the sick, make a cursory examination of each man and then detail some or sometimes all of them to go to work. Protest after protest was made by officers but this inhuman practice continued. The worst sufferers were the malaria cases. Scarcely a man was not subject to chronic malaria. A perfunctory inspection of a malaria case seldom reveals any serious or obvious infirmity, and the Japanese, because they could not or would not see anything seriously wrong with malaria patients, sent them to work.

There was a small hospital in each camp and there were base hospitals to which sick men could be evacuated with the authority of the Japanese, but they were without proper medical or surgical facilities; drugs and dressings were practically non-existent and the medical officers had only the instruments they brought into the country with them. None

the less, many major surgical operations were carried out and hundreds of men undoubtedly owe their lives to the skill, courage and ingenuity of the medical officers and their staffs.

The first death of an R.A.N. man on the railway occurred in March 1943 when a rating died of malaria and dysentery. In June three more men died, malaria claiming one, septicaemia another, and dysentery and starvation the third. After a lull more deaths occurred. October was the worst month with nine deaths, seven from dysentery and malnutrition and two from the effects of malaria and malnutrition. When Williams Force reached the 80 kilometre camp they found a hut full of extremely sick men who had been left behind by No. 5 Group. Many of the survivors of *Perth* were among them. With little food and scarcely any medical attention, they were dying at the rate of two or three a day, and a desperate appeal was made on their behalf to the Japanese major in charge of No. 5 Group. He replied "Let them die".

At the end of October 1943 trains began running on the Burma-Thailand railway and by the end of the year most of the work had been completed. With the easing of labour conditions and the end of the monsoonal season, which meant healthier weather, the death rate began to fall. Between January and March 1944, however, eight more naval personnel died, and three in 1945, which brought the total in the Burma-Thailand area to 55, including two ratings killed at Tavoy on the coast in Allied bombing attacks.

A number of R.A.N. prisoners lost their lives in Japanese transports through Allied action. Two coastwatchers, captured in New Britain and New Ireland, were in the *Montevideo Maru,* which was sunk by the American submarine *Sturgeon* while en route to Japan from Rabaul in July 1942; two ratings from *Perth,* already mentioned, died in Burma as the result of injuries when the *Moji Maru* was bombed by Allied planes in January 1943; 33 men from *Perth* lost their lives when the *Rakuyo Maru* was sunk by the American submarine *Sealion II* while on its way from Singapore to Japan in September 1944, and another two ratings from *Perth* were in the *Eiko Maru,* which was sunk by an R.N. submarine. Five naval personnel were killed during Allied air raids on enemy territory; two from *Perth* in Burma and three from *Perth* in Tokyo. The last named were survivors of the *Rakuyo Maru.*

On 11th September 1944 H.M. submarine *Porpoise* left Fremantle with a group of commandos on board whose object was to attack Japanese shipping lying in Singapore Harbour. Lieut-Colonel I. Lyon of the Gordon Highlanders, who had led a similar attack against shipping in the harbour the previous year, was the leader of the party which included 7 officers and 16 other ranks of the army, navy and marines, with Australians predominating over English in the ratio of three to one. The possibility that they would be captured and tortured could not be ignored. It was realised that no man, however determined, could withstand extreme pain indefinitely: he would either crack and give information, or die—and

obviously it was better for him to die quickly. An issue was therefore made of cyanide tablets, known as "L" (lethal) tablets, which were packed in a tiny lead-foil envelope to make for easy concealment. If necessary, the envelope could be slipped into the mouth quickly: one bite would bring death in fifteen seconds. *Porpoise* landed the commandos on Merapas Island, arranging a rendezvous for the 8th November. The party managed to capture a junk and in this proceeded towards Singapore. On 6th October they were intercepted by a Malay patrol boat off Singapore and forced to retire. In subsequent fighting with Japanese forces on Sole, Merapas and other islands 4 were killed and 9 disappeared without trace. The remaining 11 were taken prisoner: one rating died, and the rest were executed. As they were not tortured, there was no point in forestalling their executioners.

Of the Australian naval men who were taken prisoner throughout the war 33 officers and 229 ratings survived and were repatriated. Six officers and 113 ratings died in captivity, including 5 officers and 4 ratings who were executed.

CHAPTER 8

SHIPWRECK

THE subject of shipwreck was earnestly studied in Britain and elsewhere for a considerable period before the outbreak of the 1939-45 War and information was compiled and special equipment prepared for use of those in lifeboats and on rafts. In 1943 the British Medical Research Council's Committee on the Care of Shipwrecked Personnel published a memorandum entitled *A Guide to the Preservation of Life at Sea,* and this, with information gained from organisations acting in the interests of shipowners and seamen, was used by the British Ministry of War Transport as the basis of a pamphlet on shipwreck, which appeared in April of the same year. This pamphlet was later reprinted in Australia on water-proof paper for inclusion in the food tank of every lifeboat and raft.

The introduction contained the comforting information that once aboard a lifeboat or raft the shipwrecked person was well on the way to safety. Experience had shown that "of the boats adrift for more than 24 hours nearly half reach safety within five days, and it is very exceptional for lifeboats not to be picked up within three weeks: loss of life in lifeboats and rafts is very small". Even if not picked up within three weeks, anyone who managed to reach a lifeboat or raft uninjured was likely to survive for a period beyond normal expectation.

The pamphlet went on to deal with the immediate necessity of looking for and picking up others in the water, and of keeping all boats and rafts together as far as possible. Landfall or rescue might depend to a great extent on the behaviour of the shipwrecked themselves, and on the presence of a calm and confident person to take command. The person in command should see that everyone in the boat except the wounded was given some duty, and the others should carry out his orders cheerfully and promptly. This was particularly so in colder temperatures where Chinese and Indian crews, who were inclined to sit huddled up at one end of the boat, fared much worse than British crews. On the other hand, energy should be conserved by keeping calm, by not rowing for long distances, and in hot weather by doing any necessary work before the sun rose. In case no experienced seaman was on board, advice was given on navigation and a comprehensive collection of charts, together with protractor and pencil, was provided in an oilskin cover.

Methods of attracting attention were described, including pyrotechnic signals, wireless, reflection of torch on sail, other reflecting signals, whistles, churning of the sea and yellow bunting flags. It was sometimes extremely difficult for shipwrecked men to attract the attention of passing ships and aircraft, and in the stories of survivors is the recurring theme of bitter disappointment as potential rescuers loomed up and then proceeded on their way without seeing them.

Survivors were advised to protect themselves well against the elements. Unless the weather was warm and dry, wet clothes should not be removed completely but taken off and dried layer by layer, particular attention being paid to foot covering. Protective suits to keep the wearers dry and warm were part of a lifeboat's equipment. These were yellow, the colour best seen from a rescue plane. In the tropics the protective suits were also useful against sun and heat, and in dry boats the lower parts of the legs of the suits could be cut off and used to cover the head. The glare of the sun on the water was likely to cause a painful eye condition, and sunburn was another hazard, even in cloudy weather. Warnings were given against using fuel oil as a protection against sunburn. Fuel oil was a frequent source of discomfort to shipwrecked persons, for a thick coating often covered the water in the region of a sinking. The pamphlet advised that fuel oil should be removed from the face and hands with cleansing oil if this was available, taking care not to let it get into the eyes as this too would cause severe irritation.

Survivors were advised to bathe once or twice a day, but not more often. Before getting into the water they should make sure that there were no sharks or other dangerous fish in the vicinity. The pamphlet mentioned that sharks were not so dangerous as was commonly believed and that, if they rubbed against the lifeboat, they were merely trying to scrape off parasites. However, shipwreck survivors have described attacks by sharks, and attempts to discourage them by towing a container enclosing a repellent such as copper acetate. Birds were welcome if they could be caught, but occasionally they have attacked survivors. The navy recorded an attack on a shipwrecked sailor by an albatross, which inflicted a stab wound with its beak. Surgeon Captain Carr commented that "if more attacks of this nature occur, the sanctity with which the sailor has hitherto invested the albatross will become a thing of the past".

The need was stressed for getting regular sleep during watches off, for the issue of rations at regular hours, and for deliberation in the manner of eating and drinking. It was pointed out that spirits are not really thirst quenching and might even be dangerous; that smoking, while soothing, has no other value and could increase thirst.

Fresh water was the most vital need of all. A fair amount could be carried in the casks of ships' boats, but the quantity was obviously limited and survivors were advised to look for any unoccupied rafts whose water-supply could be taken on board. If fish and birds could be caught and the raw flesh chewed, a useful amount of water might be obtained.

The lifeboat's food supply included biscuits, pemmican (concentrated fats and protein), chocolate, milk tablets, lime juice, boiled sweets and chewing gum. The biscuits, chocolate and milk tablets were criticised by some survivors because they were too dry and the pemmican because it was too salty. Generally, when enough water was available all these foods were appreciated, but when it was not, only the boiled sweets could be eaten with enjoyment.

The pamphlet, in its medical section, described the Schafer method of artificial respiration for the treatment of the apparently drowned, methods of dealing with pain and shock, and the general treatment of wounds, including broken bones, bleeding from leg, arm and chest wounds, belly and head wounds. Warnings were given about the care necessary in the application of tourniquets and the danger involved in drinking whisky where there had been severe bleeding. Inflammation of the eyes, seasickness, feverishness, diarrhoea and cramp were other conditions described.

Suggestions were made for the treatment of various conditions of the skin such as burns, sunburn, frostbite, abrasions, cracked skin caused by sun and salt water, and salt water burns (boils). When leaving a foundering ship men were likely to receive cuts and bruises, perhaps from the incrustations of barnacles on the lower sides and bottom. These injuries could be so irritated by fuel oil, salt water and burning sun as to become septic. Captain Toralf Andersen of the Norwegian tanker *Ferncastle,* sunk by the German armed merchant cruiser *Michel* five days out of Esperance, Western Australia, recorded that men in the lifeboat with him who included Australian D.E.M.S. personnel had sores all over their bodies, that some who had injured their hands when getting into the boat suffered severely from inflammation, and others were tortured by boils which tended to break out in spots where injuries had been received previously. The men's condition was aggravated by the fact that the boat shipped water, so that they were wet nearly all the time.

The condition known as "immersion foot" also received attention. In the early numb stage, and especially the very painful hyperaemia which followed, great care was needed to minimise possible necrosis. Adequate instructions were given in the brochure.

A point which cropped up again and again in the reports of survivors who had to spend some time in lifeboats or on rafts was the sluggishness of excretion: the urine was usually scanty and concentrated, and bowel function might be in abeyance for a long time. Captain Andersen of *Ferncastle* described how equipment was improvised and an enema administered to those of the lifeboat's crew who required it. However, the department's pamphlet emphasised that this condition did not call for alarm or action, and that laxatives should not be taken, even if available, as they could cause harm when little food had been eaten.

Usually the resources of the first-aid outfit were sufficient to enable survivors to take care of any of their number who had been injured by enemy action or in leaving the ship, and it was necessary that the usefulness of the outfit should be extended by proper economy. Where the first-aid equipment in lifeboat or raft was insufficient or perhaps missing altogether the difficulties of survivors were increased. In December 1942 H.M.A.S. *Kalgoorlie* picked up 49 survivors from H.M.A.S. *Armidale,* who had drifted in a motor-boat and an open whaler for nine days. Unfortunately these boats were inadequately stocked with first-aid equipment. Lieut-Commander H. A. Litchfield, of *Kalgoorlie,* mentioned that it was the practice in that ship to refrain from putting first-aid bags into

the boats until they had entered enemy waters. The purpose was to avoid spoiling material by exposure to rain in the wet season, but in view of the suddenness with which air raids materialised, Litchfield recommended that some form of sealed canisters be supplied for first-aid outfits so that they could be left in the boats and rafts all the time. In the case of the survivors from *Armidale,* had it not been that supplies were dropped by parachute, they would have experienced even greater hardship than they did.

In H.M.A.S. *Australia* salvaged 5-inch cordite cases were used as containers for first-aid equipment on the rafts. These cases were of light aluminium, 30 inches long and 6 inches in diameter with a watertight cap. Two were supplied to each raft, one painted blue containing water (three gallons only to secure buoyancy), and one painted grey containing the following:

Canvas sail for cover or as a flag, a knife, an electric torch, a fishing line and hooks, two short lights, sulphanilamide, Tannafax, an opium mixture, acriflavine, aspirin, triangular bandages and pamphlet. Tins of milk and water in canvas hose were also supplied.

It was not until the war was almost over that a unit of medical equipment for the shipwrecked was prepared and distributed. It consisted of a small pack in an air-tight tin and contained the following:

Description	Quantity
Acid, tannic jelly, 4 oz tubes	4
Tubunic morphia, gr. ½	36
Liquor iodi mitl B.P. 1½ oz screw-top bottle	1
Guttae cocaine in ol. ricini, 1 oz bottle	1
Sulphanilamide in 3 oz shaker	1
Mosquito repellent lotion, 4 oz bottle	1
Tabs pro oral	
Atebrin 0.1 gm.	100
Energy (benzedrine)	50
Tabs pro solution	
Acriflavine	50
Ung. acidi borici—4 oz tubes	4
Dropper, eye, glass, in tin	2
Measure, glass, medicine, 1 oz	1
Bandages, W.O.W. 1″ x 2 yds	12
Bandages, W.O.W. 2″ x 2 yds	12
Bandages, W.O.W. 3″ x 4 yds	12
Bandages, triangular (compressed in packets of 2)	3 pkts
Lint, absorbent, 4 oz packets	1 pkt
Plaster, adhesive, 3″ x 5 yds	1
Shell Dressings	12
Forceps, splinter	1
Scissors, counter, 8″	1 pr
Tourniquet, Samway	1
Wool, cotton, absorbent	½ lb
Box, bondwood, steel bound	1

On 10th December 1941 *Vampire* rescued survivors from the *Prince of Wales* and *Repulse*; two died subsequently from blast injuries and one

from severe shock following burns; the commonest injuries were fractures, lacerations and shrapnel wounds, and the majority suffered from chemical conjunctivitis, and several required resuscitation. The medical officer of *Vampire* recommended that means of resuscitation should be carried aboard destroyers for use on survivors of wrecks. Fortunately on this occasion several of *Vampire's* crew were well versed in the standard methods of life-saving as practised by surfing clubs. *Yarra, Bendigo* and *Wollongong* rescued all the survivors from the troopship *Empress of Asia* when that ship was bombed and set afire while approaching Singapore; many of the men were suffering from shock and exposure.

The injuries sustained by these men who were shipwrecked after bombing attacks were more or less typical. Strangely atypical was the condition of castaways who came ashore on uninhabited islands after their ship had been bombed. *Warrnambool* rescued them in February 1943. The crew found that the shipwrecked men had been burnt, and to keep cool they had lain in sand pits which they dug on the beach; the sand had caked over the burnt areas and moving them was both painful and difficult. These men showed ample evidence of the value of anti-flash clothing, as every part of their bodies reasonably covered during action was free of burns.

Crews of other ships of the R.A.N. had personal experience of shipwreck. In March 1942 when *Yarra* was attacked by a Japanese naval force and sunk, 34 of the 152 men on board managed to get to Carley floats or to makeshift rafts. They were all ratings with the exception of one, a Dutch officer previously rescued by *Yarra.* The survivors lashed the rafts and floats together and took an inventory of their provisions. These consisted only of a tin of biscuits, which had been picked up from the sea, and two gallons of water. Strict rationing was immediately instituted—one biscuit and one tablespoonful of water to each man daily. On the third day when the men were changing their positions the floats overturned and the remaining biscuits and water were lost. Some of the party then decided to try to reach the coast of Java, about 300 miles away. On the same morning one of the men who had elected to stay fell overboard from a raft, and was too weak to swim back. Five of his shipmates dived to his rescue. They managed to put him back on the raft but were unable to get on it with him to apply artificial respiration, and he later died. On that day and later some of the other men became mentally deranged, and they swam away from the rafts and were not seen again. On the fifth day the survivors, who now numbered only 13, were picked up by a Dutch submarine, *K 11,* which took them to Colombo.

Other R.A.N. personnel, mostly D.E.M.S. gunners, survived the loss of the merchant ships in which they were serving. When the s.s. *Sibigo* sank during a cyclone in the Coral Sea in March 1945 there were 10 survivors. Three of the D.E.M.S. gunners managed to scramble on to a raft. The second mate, two wireless operators and two Javanese joined them, and while they were floating alongside the stricken ship they saw the gunlayer, Able Seaman J. S. Murray, in the water. They managed to haul

him and another Javanese on board. At that moment the *Sibigo* keeled over suddenly, the raft fortunately being swept clear by a big swell. It was then late afternoon. The cyclone continued to rage, and before midnight the raft capsized five times. On one such occasion a Javanese was lost; on another one of the wireless operators. In the morning the provisions were found to consist of 10 tins of bully beef, 14 tins of evaporated milk, 2 tins of biscuits, 2 lbs of chocolate, as well as some medical stores. Any water which might have been on the raft had been lost when it capsized. By the third day the swell had subsided, and the survivors rigged a "distress flag". Three transport aircraft flew directly overhead but very high and did not see the raft. The next day it was decided to rig the flag as a sail. The wind was now north-westerly, and it was thought that land or the reef could not be very far away. At this stage everyone was in fairly good condition, and morale was high. On the fifth day a Mariner aircraft appeared, apparently in search of them, but in spite of efforts to attract attention, it flew off over the horizon without seeing them. That night it rained and blew very hard. Murray was wearing only a singlet and the rest of the men shirts and shorts, but even had they been more warmly dressed, they would have suffered from the cold for seas were breaking over the raft continuously.

By now the second mate and the wireless operator had become ill. The rain was their only good fortune. They managed to catch some of it in canvas, and that night each man drank about a tumberful. About 11 a.m. next day—the survivors' sixth day adrift—a Mariner aircraft appeared. It sighted the raft and began circling overhead. Numerous packages were dropped, but all of them fell behind and, as the raft was drifting faster than the packages, they could not be picked up. At 3 o'clock Murray decided that he would swim back to one of the packages. The others tried to dissuade him from taking such a risk, but he pointed out that the second mate and the wireless operator, in particular, were badly in need of food and water. He swam to the nearest package on a lifebuoy and, when he reached it, was about 30 yards behind the raft. On starting back he found the current too strong and himself too weak to cover the distance. Those on the raft attempted to paddle towards him but could make no headway. Another of the gunners, Able Seaman H. D. Robertson, prepared to dive to Murray's assistance, but the latter shouted out to him to stay on the raft. Gradually he drifted farther and farther away. The aircraft dropped three buoys not more than 15 yards away from him and those on the raft thought that his plight had been recognised and that the aircraft would bring help. Their last sight of Murray was at about 4.30. He was then still clinging to the lifebuoy. One of the other gunners said: "Murray, whom we looked upon as our leader, always thought first of our safety, and proved himself a brave and courageous shipmate."

About 5 p.m. those on the raft saw another Mariner aircraft, but it flew off without sighting the raft. In the night the swell increased and the men sat huddled together shivering in the wind and rain. That, however,

was to be their last night of ordeal. On the seventh day a ship appeared, and they were picked up.

The two D.E.M.S. gunners on board also survived the sinking of the s.s. *Nellore,* when, in June 1944, she was torpedoed by an enemy submarine in the Indian Ocean. All the lifeboats got away. The one to which the gunners had been allotted carried, in addition to themselves, 5 Australian crew members, 7 Javanese and 33 Indians. After watching the ship go down sail was hoisted and a course set for Diego Garcia. Food and water-supplies had to be severely rationed as the lifeboat was overcrowded, some of the Indians on board belonging to another boat which had left without them. For most of the time the weather was bad with strong winds and rough seas. With every gust of wind it seemed that the mainsail, which was in a bad condition, would be torn to ribbons, and five times en route it had to be patched. Rain fell a few times and, although it added to the discomfort in the boat, it was welcomed as a supplement to the water-supply. On the 14th day adrift the first death—an Indian seaman—occurred. Thereafter there were deaths among the Indians every day, and later the Javanese began to die. The survivors thought that the largest contributing cause was the drinking of sea-water. There were, of course, the other factors of exposure and lack of food and water, but these applied to all. When they had been sailing for about 23 days the boat sprang a leak. With failing strength they managed to repair it and six or seven days later land was sighted. While attempting to reach it through a heavy surf the boat was swamped and everyone washed overboard, but they succeeded in reaching the shore. The survivors then consisted of the seven Australians, an Indian and a Javanese woman and her baby son.

A controversial point in discussions on the survival of the shipwrecked was the advisability of drinking sea-water. After men had been adrift about three days without enough fresh water the temptation to drink sea-water sometimes became overpowering. Some experimenters in the laboratory and the field suggested that it might not be harmful to the shipwrecked to drink small quantities. This was not borne out by the statements of some survivors, a few of which have been referred to, who described how death, delirium and madness overtook those who succumbed to the temptation.

When the s.s. *Umona* was sunk west of Freetown three men, including the radio operator, managed to get on to a small float. They were sighted by a ship 13 days later, but by this time the radio operator had died. One of the others said "we did not drink salt water, but I think it was this which killed the radio officer". Of 14 men who reached a raft when the s.s. *Lulworth Hill* was sunk west of Portuguese West Africa only two were alive when help arrived after 50 days. One of the survivors wrote "six of those who died were less than 18 years old, and these began surreptitiously to drink sea-water. As they drank more and more they began to imagine that they saw rivers of ice and snow; three of them jumped overboard, and others became violent." Of 18 survivors of

the s.s. *Rio Azul,* sunk south-east of the Azores, 7 died. According to the report six "died from drinking salt water. One of the military gunners went mad. He conceived the idea that if he swam a little way he could find fresh water. He jumped off the raft and swam round in circles on several occasions, and we had difficulty in getting him back on the raft. Finally he went over and was too exhausted to get back and was drowned."

If any doubt remained on the subject, this was dissipated by the post-war findings of the Royal Naval Personnel Research Committee. The committee issued a report—*The Hazards to Men in Ships Lost at Sea, 1940-44*—which was based on the reports of the shipwrecked, and which included an analysis of the death rates on the voyages where it was recorded that sea-water was drunk by one or more of the men (sea-water group), and those where no positive statement was made that sea-water was drunk (control group). The total deaths from all causes in the sea-water group and the control group were compared. In the sea-water group 29 lifeboat voyages were considered; 997 men were at risk and 387 died. In the control group 134 lifeboat voyages were considered; the number of men at risk was 3,994 and the men who died 133.

The difference between the two groups (the authors remarked) is even more striking when it is remembered that: (*a*) not all the men in the sea-water group drank sea-water; (*b*) some of the men in the control group may have drunk sea-water, although it was not recorded; (*c*) the mortality rates included deaths from all causes.

CHAPTER 9

SALT DEFICIENCY AND HEAT EXHAUSTION STATES

IT is probable that the inducement to add salt to food occurred as man developed from a hunter living on an exclusively animal diet, to a shepherd and a tiller of the soil eating mainly vegetables. Vegetables contain a great deal less salt than meat, and so man began to suffer from a shortage of salt and to develop a craving for it; the influence this had on his way of living can be seen from the history of his customs and from his writings.

For more than 2,000 years it has been recognised that high external temperatures may have an injurious effect on the human body, and the effects of heat have been described in medical literature for some 200 years; little was known, however, about the pathological processes involved in the effects of heat until the beginning of the present century when they were noticed in workers in the iron and steel industries. One of the pioneers in the systematic investigation of these states was Edsall, who recorded in 1904 the significant finding of a diminished excretion of chlorides in the urine of patients showing clinical signs of cramps and prostration after exposure to intense heat. During the war of 1939-45 the importance of disorders resulting from high temperatures increased greatly, especially on ships operating in tropical waters. The need to replace the sodium chloride lost in sweat assumed great significance.[1]

This chapter records experience gained in Australian naval vessels during the war period in tropical climates, including the Gulf of Aden and the Red Sea, the East and West African coasts, and the equatorial zones of the Indian and Pacific Oceans. Although the climate of a tropical zone could not be controlled, much could be done to mitigate its ill-effects, and in this the medical officer contributed greatly to maintaining the health and contentment of a ship's crew.

Physiological Factors. The use of salt in food is neither regular nor reliable, and varies greatly according to individual taste. The natural intake of salt in an ordinary mixed diet is probably less than 3 grammes a day, but with that added during cooking and at the table, the daily average would be about 10 grammes. The approximate sodium content of common articles of diet is given in the accompanying table.

	Milligrammes per 100 grammes
Meat	65-80
Milk	43
Eggs	185
Offal (liver, kidney, ham)	110-160
Fish	120-190

[1] In writing this chapter the author has leaned heavily on Surgeon Lt-Cdr M. J. L. Stening's article "Salt Deficiency States in Tropical Climates", *Journal of the Royal Naval Medical Services*, Vol. 31, pp. 129 and 195 (1945).

	Milligrammes per 100 grammes
Cereals	5-30
Potatoes	3-4
Vegetables:	
green	3-15
root	10-60
Nuts	2-4

In temperate climates an ordinary mixed diet, palatably salted, supplies the normal mineral needs of the body. In the tropics, however, especially if there are also factors of bad ventilation, unsuitable clothing and muscular work which cause profuse sweating, the great amount of salt so lost calls for an increased intake which is varied according to the need. In a series studied by Surgeon Lieut-Commander M. J. L. Stening, in *Australia,* the ration of salt varied from 4 grammes a day in more favourable conditions to 8 grammes a day in adverse conditions. Some men who felt the need for increased amounts of salt took voluntarily as much as 30 grammes a day with benefit. The ration was best absorbed, and interfered least with the appetite, if taken independently of food—say before breakfast and before going to bed. If taken in water in a concentration of about 2 grammes per cent, the flavour of the water was pleasant. Saline solution, however, was not the most popular medium, and salt was more freely taken as salt, although Surgeon Lieutenant C. K. Churches in *Warrego,* who had to supply salt tablets for the boiler-room staff, found that men would take salt in tablet form where they disliked other methods of administration. A convenient salt tablet contained ½ gramme with an additional equivalent amount of dextrose, taken in one to three doses daily. Curiously, a taste seemed to grow for it, due perhaps to the allaying of thirst which should follow a correct distribution of sodium chloride in the body fluids. The benefits of taking extra salt were immediately apparent, which is surprising when it is remembered that the absorption of sodium chloride occurs mainly in the colon.

The fluid structures of the body can be divided into three parts: blood, interstitial fluid, and intracellular fluid, which represent 5, 15 and 50 per cent of the body weight respectively. The volume of the interstitial fluid is the most labile and expands or contracts with the changing physiological needs of the body. When the fluid balance of the body is disturbed this compartment acts as a buffer to the other two and may undergo profound alteration that is not reflected in the volume of blood or of intracellular fluid.

The body contains about 100 grammes of sodium, of which about half is present in the blood and tissue fluids. Whereas sodium is regarded as the main extracellular base, a similar alkali metal, potassium, is the chief cellular component. All the common salts of sodium and potassium are freely soluble, and therefore readily absorbed from the alimentary tract, but there follows the disadvantage of ineffective storage. There is no way in which the body can store reserves of these elements in an

insoluble and inactive form, and it is therefore essential to supply them constantly from the food.

Water and salt metabolism are intimately related because of the constancy with which the body maintains the osmotic pressure of the extracellular circulating fluid. Movements of water about the body are almost invariably accompanied by a simultaneous movement of salts. Sodium chloride is lost from the body in the sweat, urine and gastro-intestinal discharges. The loss from sweating is considerable: in a hot environment as much as 10 to 15 litres of sweat may be lost in eight hours, and each litre may contain 3 or 4 grammes of sodium chloride, though this amount is not constant and depends on many factors, including degree of acclimatisation and personal idiosyncrasy, as well as the rate of secretion of sweat. Normally, sodium chloride is eliminated by the kidneys, and the quantity ingested is balanced by the amount excreted in the urine, so that the body is physiologically in chloride equilibrium. The loss of sodium is even more significant for the total electrolyte content of the body fluids than is the loss of chloride. When chloride is lost, the total concentration of acid radicals can be maintained by lessened elimination of carbon dioxide in the expired air, with the result that the concentration of bicarbonate rises to the extent that the chloride falls. However, when sodium is lost the sum of the acid radicals in the blood must decrease correspondingly in order to maintain the balance of acid and base. The result is that the electrolyte content of the blood and tissues falls and dehydration is the consequence. The only significant indication then can be the replacement of the depleted sodium chloride.

That human beings have a remarkable power of adapting themselves to climate is shown by the fact that the body temperature remains the same in the arctic zones as in the tropics. It is controlled mainly by variations in the cutaneous vascular tone and in sweat-gland activity, by evaporation from the lungs and by the activity of the skeletal musculature, which are under the control of the nervous system. Very few animals have such a well-adjusted system as man, and this is one of the fundamental reasons for his exceptional ability to withstand a wide range of climatic conditions.

The body temperature is kept constant by maintaining a balance between two opposing factors—heat production and heat loss. Heat production takes place mainly in the skeletal muscles. The metabolic activities of the body at rest are so adjusted as to maintain the appropriate internal temperature. When the muscles are performing hard work, they may generate up to five or six times as much heat as they do when at rest. In cold and temperate climates heat is lost from the body mainly by contact with the cool air and by radiation. In tropical zones, where the ambient air is hot, these means are not available and heat is therefore lost by evaporation—that is, mainly by sweat-gland activity. A secondary means is by increased pulmonary ventilation: the expired air is saturated with water vapour and heat is thus lost from the lungs.

A distinction must be drawn between imperceptible perspiration, which is probably a transudate from dilated cutaneous capillaries, and sweat proper, which is an actual secretion from the sweat glands. In general, the response of the sweat glands is greatest when there is interference with heat loss. Sweating on the body surface is produced by a nervous reflex governed by the sweat centre, which is closely allied with the heat-regulating centre in the hypothalamus. Cooling by evaporation is most effective when the air is dry and in movement, and the value of electric fans and other air ventilation systems which disturb stagnant air is therefore considerable.

The importance of estimating and recording the air temperature (dry-bulb and wet-bulb recordings) and of assessing the velocity of the air current and the relative humidity, was recognised as fundamental. The conditions under which a patient suffering from clinical salt-deficiency had been working were checked by taking wet-bulb and dry-bulb recordings with a sling psychrometer. The difference between the wet and dry readings gave the degree of evaporation. The sling psychrometer consisted of a pair of thermometers attached to a handle by means of which they could be whirled rapidly; the bulbs were thus affected by the temperature and moisture of the air. A large number of readings were taken, at various stations on the ship, and revealed a wide range of conditions: from the comfort of the shaded upper deck where the readings were 90°F. (dry bulb) and 80°F. (wet bulb), to the oppressive 140° and 92° of the boiler room.

In order to determine the degree of salt deficiency, it was found unnecessary to resort to elaborate plasma-chloride estimations; the information could be obtained accurately enough by quantitative assessments of the concentration of chlorides in the urine. In all cases of salt deficiency diagnosed in Stening's series, urinary chloride was shown to be low. The method used was to add 5 drops of pure concentrated nitric acid to 5 cubic centimetres of the patient's urine. The test was completed by adding 5 drops of a 1 per cent solution of silver nitrate. It was found by experience that the diminution of urinary chlorides could be classified as follows:

Thick curdy precipitate produced instantly.	Normal reaction. No diminution.
Curdy precipitate slow to form. Loss of curd on movement of the test tube with formation of white deposit.	First-degree diminution.
Absence of curdy precipitate but appearance of a white haziness without deposit.	Second-degree diminution.
No precipitation, no haziness, no change.	Third-degree diminution.

In association with this test a quantitative estimation of urinary chloride was introduced, and served as a confirmatory check of the qualitative assessments. This estimation was of great value and reliability in determining prognosis and response to treatment. It was found that the danger-

ously low level of sodium chloride excretion was 3 grammes a day; readings of a urinary output of 5 grammes or less a day indicated urgent salt replacement therapy. When it was not practicable to make daily estimations of the urinary output, importance was attached to readings less than 0.5 gramme sodium chloride per cent in a urinary specimen. Three solutions, A, B, and C, were prepared for making these tests:

A: 29.075 grammes of fused silver nitrate per 1,000 c.cm.
1 c.cm. = 0.01 gramme sodium chloride.
B: 40 c.cm. of a saturated aqueous solution of iron alum mixed with 600 c.cm. concentrated nitric acid.
C: Potassium thiocyonate.
1 c.cm. = 1 c.cm. of solution A.

The estimation was performed by taking 1 cubic centimetre of the patient's urine and 3 cubic centimetres of solution A and 1 of solution B. These solutions were mixed and titrated with solution C until the red end-point. The number of cubic centimetres of solution C used, subtracted from 3.0, gave the urinary sodium chloride in grammes sodium chloride per cent.

The routine examination and treatment of patients suspected of salt deficiency in Stening's series took the following course. The patient was asked how long he had been in the tropics, to determine his degree of acclimatisation; he was given a physical examination, which included sphygmomanometer, pulse, respiration and mouth-temperature readings, and estimations were made of his urinary chloride diminution and of the sodium chloride excreted in the urine. Temperature and humidity readings were then taken of his place of duty, and from this and his clinical condition the method and strength of the salt dosage were decided. His response to treatment was observed, and he was given advice for keeping himself fit in the future.

In this series, approximately 120 patients were diagnosed, investigated and treated for clinical states of salt deficiency, although a considerably greater number derived great benefit from salt consumption for sub-clinical states. In fact it is doubtful whether any single member of a ship's company who served at sea in the tropics for more than six months was not affected to some extent by uncompensated salt loss.

Symptoms of salt deficiency in the sub-clinical states included: faintness, dizziness, headache, lack of concentration, mental apathy, and irritability, anorexia, weakness, postprandial nausea, undue tiredness and lethargy, disinclination for effort, sleeplessness, mild nocturnal cramps, frequency of micturation without polyuria, and insatiable thirst.

It was commonplace in areas of high heat and humidity to find whole ships' companies, particularly troops in transports who were not acclimatised, complaining of lack of energy and concentration, undue tiredness, and other symptoms which were lightly ascribed to "tropical neurasthenia". With the lowering of basal metabolism that results from exposure to the heat of the tropics, the rate of oxidation in the tissues is adjusted to maintain the appropriate internal temperature. To keep heat production

at a low level it is therefore necessary to reduce the amount of muscular work and to conserve energy. In the tropics heat production at rest is only about 30 large calories per square metre, compared with 40 in temperate zones. However, this grading of muscular activity and lowering of the metabolic rate do not of themselves impair a man's efficiency or rob him of enthusiasm. The symptoms already listed were at first subliminal, and were dangerous in a member of a fighting ship. The gradual and cumulative effect of salt loss is insidious in its onset, aggravates existing symptoms, and usually brings others in its train. The improvement in general well-being and strength which follows an adequate, routine dosage of salt, can only be experienced satisfactorily by contrast with the former lethargy and asthenia. Sodium chloride deficiency then reveals itself as a real phenomenon.

R. A. McCance produced experimentally a severe salt deficiency in patients who sweated profusely after exposure to a radiant heat bath. He found great differences in the individual losses of water and of sodium chloride; the amount of sodium chloride lost ranged from 0.14 to 3.65 grammes, under the same conditions of heat and time. Such differences explain why some people escape the major symptoms of salt deficiency.

Another variable to be considered is the speed with which some individuals show signs of deficiency compared with others who have lost about the same amount of salt. It seems likely that the critical sodium chloride level is a function of individual susceptibility and, especially, of acclimatisation to heat. The well-known resistance of the inhabitants of India, tropical Africa, Arabia, Melanesia and other zones of the "brown tropics" to hot environments, is an example of perfect acclimatisation. The degree of acclimatisation necessary for men who are serving in ships in tropical zones, where they may be forced to eat, sleep, rest and take recreation in sweltering heat for many months without respite, is built up slowly but surely and depends on many factors in addition to habituation to intense heat. Stening recorded that new ratings without previous service in the tropics were exposed gradually to the sun with beneficent effects. There was a marked difference between the good health and relative freedom from heat-exhaustion states of seamen whose duty was on the upper deck and the condition of stokers and other ratings between decks.

The induced state of acclimatisation is akin to the condition of an athlete in training; physical fitness or endurance can only be acquired by degrees, and are quickly lost if the subject is affected by intercurrent disease or if he disobeys the primary rules laid down for those in training. Training on a ship in the tropics includes careful personal hygiene, improved living and working conditions, freedom from intercurrent disease, and a knowledge of the occurrence and prevention of salt-deficiency states.

The clinical states of salt deficiency can be listed for descriptive purposes as:

Heat exhaustion proper, or heat shock;
Heat exhaustion with abdominal pain;
Heat cramps: acute severe, or chronic mild;
Salt-deficiency state with gastric symptoms:
    dyspeptic type;
    vomiting or emetic type.
Salt-deficiency state with alimentary symptoms:
    apyrexial diarrhoeic type;
    vomiting-diarrhoea-pyrexial type.
Salt deficiency state with low-grade pyrexia;
Heat-stroke proper, or hyperpyrexia.

Heat shock. When an individual is subjected to intense external heat, distinction must be drawn between the clinical state, resulting from the profuse sweating secondary to the exposure, and that following the effect of heat itself on the body. It is in circumstances of extremely high heat and humidity that the danger of inadequate heat loss from insufficient evaporation may occur. The natural powers of cooling may be overwhelmed and the body temperature may rise, causing not only retention of heat but actual increased production. Treated symptomatically in a cool atmosphere, these patients will recover readily if the exposure to extreme heat has not been too prolonged. However, when individuals are exposed to environmental conditions favouring profuse sweating, the uncompensated loss of salt from the body may manifest itself clinically in states closely allied to "effects of heat" cases. The predominant sign in the clinical picture of heat exhaustion is shock associated with demonstrable diminution of sodium chloride excretion in the urine.

The safeguard of prophylactic salt administration against the occurrence of heat exhaustion does not seem to have been the subject of concern in many ships in tropical climates, and the morbidity and even mortality in ships' companies, particularly in closely-packed troop transports, was not inconsiderable. It was in handling problems of this nature that ships' medical officers felt their isolation from their fellows so keenly. Surgeon Commander J. M. Flattery tells how he treated cases of heat exhaustion, two of them severe, in H.M.A.S. *Australia* in 1941. Beyond a knowledge that salt was lost from the body by excessive sweating, and a vague statement in one of his medical text books that taking sodium chloride and water freely should be helpful in preventing heat cramps, he had no guidance on how to handle such cases or how to determine the appropriate dose of salt. He decided, however, to persuade every member of the ship's complement to take extra salt daily as a prophylactic measure. After this regimen had been introduced only one case of heat exhaustion occurred, and that was in a stoker who had not been taking the salt in case it made him sick. The problem in *Australia* was aggravated by the ship's travelling for 15 months continually backwards and forwards from the tropics to very cold climates; this made acclimatisation impossible, and the men were inevitably more susceptible to the effects of heat.

At every possible opportunity Flattery discussed the problem with medical officers of other ships, including hospital ships, to discover

whether the simple precaution of taking extra salt had been adopted, and whether it was regarded as a commonplace. In only one instance did he find it to be rigidly enforced, but the majority of officers said frankly that the practice of taking extra salt as a strict routine was completely unknown.[2] The majority of cases of heat exhaustion, and all those of severe degree seen in Stening's series, occurred before the daily ration of salt was introduced. Once the men became "salt-minded" the number of cases fell sharply, and those that did occur were less severe; there were no deaths in this series.

Stokers, who were exposed to unusually hot conditions in the boiler and engine-rooms, were affected most commonly. The patient frequently fainted or collapsed on duty and was carried semi-conscious to the sick bay. Questioning usually revealed a prodromal phase for some days previously, of lassitude, dizziness, weakness, nausea and headache, or in short the symptomatology of the sub-clinical states of salt deficiency. Because the state of shock precludes the other signs of heat prostration, the more expressive term "heat shock" is preferred. The clinical manifestations of this shock were similar to those encountered in the shock of trauma, operation or haemorrhage; they included cold extremities, a pallid and moist skin, feeble or impalpable pulse, and collapsed superficial veins. In heat shock thirst was a common complaint and the patient frequently vomited if fluids were given by mouth. The mouth temperature of patients in this collapsed condition was lowered to an average reading of 97.4°F. In addition to the marked pallor of the skin there was pronounced evidence of dehydration in the eyeballs (intra-ocular tension), tongue and sunken cheeks and temples. The pulse was rapid in rate and low in tension to the degree of impalpability, and the blood pressure was always depressed, affecting both the systolic and diastolic values more or less proportionately (average readings 100 and 60 millimetres of mercury).

Abdominal symptoms, varying from the discomfort of minor gastric disturbances to severe pain, diarrhoea, repeated vomiting and mild or severe abdominal cramps, may complicate the clinical features of the collapse of heat exhaustion. In the stage of recovery after the initial collapse, the pulse, although still rapid, is of better volume and the blood pressure rises to normal readings. The mouth temperature rises usually to a level slightly above normal. A mild pyrexia of 99 to 100.4°F. may last for 36 hours, and particular regard should be paid to these readings. The skin becomes warmer and the reactionary sweating may be profuse. This fact, like the fever, is carefully noted in heat-exhaustion cases, and is a good prognostic sign. When a rise in temperature occurs in patients with a dry pungent skin, incipient heat-stroke is indicated.

If treatment is prompt, the prognosis is good and recovery is the rule. The readiness with which heat-stroke can occur if the patient is not immediately and effectively treated, makes the diagnosis of heat shock of paramount importance. Theoretically heat-stroke should not occur if

[2] J. M. Flattery, "Experiences of Salt Deficiency", *Medical Journal of Australia*, 2 Jan 1943, p. 5.

prophylactic treatment is carefully planned and observed, and if heat shock is diagnosed accurately and early and treated correctly.

A considerable loss of water and salt from the body has already occurred in patients before the onset of heat shock, with the result (particularly if the fixed base—sodium—of the extracellular fluid is depleted) that the body becomes dehydrated and the circulating blood volume diminishes as part of the general dehydration. The oligaemia, in turn, lessens the venous return to the heart, with consequent extra-cardiac circulatory failure and shock. The loss of salt plays the essential part in the causation of the dehydration underlying shock. It is assumed that the water content of the body is largely a function of the quantity of dissolved electrolytes; unless the electrolytes are replaced, therefore, dehydration cannot be alleviated by the supply of water.

There are thus two essentials in the treatment of heat shock: a suitably cool environment and a ready correction of the deficiency of sodium chloride in the body fluids. In most forms of peripheral circulatory failure with shock, the administration of sodium chloride solution is a valuable measure. This is especially true when dehydration has occurred. Shocked patients can rarely take fluids by mouth. Intravenous infusion is the method of choice, usually in the form of an isotonic (0.9 gramme per cent) solution of sodium chloride. Hypertonic saline (1 litre of 2 per cent, or ½ litre of 5 per cent solution) may be infused slowly if a more rapid replacement of the depleted electrolytes is desired. Normal saline was used in all the cases in Stening's series when intravenous infusion was indicated.

The following case report is typical of patients seen by Stening. A stoker aged 22 years collapsed while on watch in the engine-room and was carried into the sick bay semi-conscious. He was extremely pale, with a cold sweaty skin. Sphygmomanometer readings showed a systolic pressure of 100 millimetres and a diastolic pressure of 70 millimetres of mercury. His radial pulse was palpable (120 per minute) and mouth temperature 97.4°F. He did not complain of abdominal pain, but felt faint and dizzy. His urine showed a second-degree diminution of sodium chloride and a quantitative estimation of 0.2 gramme per cent.

It was learned that he had had a prodromal period of two or three weeks complaining of undue tiredness, occasional attacks of giddiness and faintness, and nausea at meal times with no appetite for food. During the night he had been restless and did not sleep well, but he ascribed this to the fact that he had only been at sea for a few months and was not yet accustomed to disturbed hours of sleep. When he was off watch he spent most of his time on the stokers' mess-deck (lower deck), where the atmospheric conditions were particularly bad—indeed, not a great deal better than those in the engine-room itself. He was not acclimatised to tropical conditions and although instructed had not placed much importance on the regular intake of extra salt.

The response to treatment in this case was rapid. One litre of normal saline was infused intravenously, and then salted fluids (½ dram of salt

in water each half hour for six doses) were readily taken without nausea. His mouth temperature rose to 101° on the first day. The qualitative urinary assessment showed a first-degree diminution after the ingestion of a little more than 36 grammes of salt. On the second day the patient was afebrile and felt much better. By the third day there was no diminution of urinary chloride, and from that stage a routine minimum dosage of 1 dram of sodium chloride was taken twice a day and increased when he had additional muscular work or when conditions were unusually hot, or when he experienced the subjective feelings associated with the subclinical state of salt loss.

Heat exhaustion with abdominal pain was treated as a separate clinical state because of the relative frequency of abdominal pain of varying degrees of severity and in different parts of the abdomen, associated with but precluding the collapsed condition of heat shock. Because the state simulated surgical abdominal conditions, particularly acute appendicitis and a perforated peptic ulcer, a standard method of treatment was adopted which allowed hypochloraemia to be dealt with but did not interfere with the conservative observation of the abdominal condition. The response of each patient was rapid and the diagnosis established well within a prescribed six-hour period. Medical officers who were unfamiliar with the diagnosis of heat exhaustion with abdominal pain found it difficult to decide whether to treat these as emergency surgical cases or to wait until the condition had declared itself. Of the eight patients diagnosed with and treated for this condition in Stening's series, all were working between decks, and the majority were stokers in the engine and boiler rooms. Early in the series one patient had a laparotomy performed because of an incorrectly diagnosed perforation of a duodenal ulcer.

Three distinct types were seen, simulating clinically the symptoms and features of acute appendicitis, perforated peptic ulcer, and a non-specific intra-abdominal catastrophe respectively.

In the first group—four appendiceal cases—pain of a colicky, cramp-like nature began in the region of the umbilicus, but moved in two or three hours to the lower right abdomen and became a dull, persistent pain. The onset of pain was associated with nausea, and in some cases vomiting. The shock in these four cases was not as pronounced as in the other types, but the patient looked pale and had a moist skin. The mouth temperature was slightly raised and the pulse disproportionately rapid (average 110 per minute) and of good volume. The rectum was not tender. There was as a rule no true muscular guarding, but deep tenderness in the right lower abdomen.

The provisional diagnosis of perforated peptic ulcer was understandable when the patient had complained of excruciating upper abdominal pain which occurred suddenly and caused him to fall to the deck writhing in agony. Associated with this pain was shock of a moderately severe degree, and a rigid abdomen caused by generalised and persistent cramp-like contractions of the abdominal musculature. A prodromal phase might

include nausea, occasional vomiting, anorexia, and postprandial dyspepsia, for weeks beforehand. Physical examination revealed deep tenderness of the abdomen but localised to a most tender area in the epigastrium. The greatest confusion in the differential diagnosis was caused by the reaction of the abdominal muscles to palpation: very gentle palpation of the muscles, or sudden pressure, produced a violent contraction of the muscles, after which they became board-like and painful. In severe paroxysms the stony hardness of the affected muscles was characteristic. The spasms did not yield to deep pressure and the more prolonged the period of palpation, the more severe the pain and the more board-like the rigidity.

In the third type, of which there were three cases, the sudden occurrence of severe abdominal pain associated with faintness and collapse suggested an intra-abdominal catastrophe of indefinite origin, such as the rupture of a hollow viscus or intraperitoneal spontaneous haemorrhage. The clinical signs supported this view incompletely, but the appearance of marked pallor in a patient with a cold and clammy skin, rapid pulse of low tension, increased respiratory rate and non-localised deep abdominal tenderness without muscular guarding, was disturbing until the diagnosis of salt deficiency was confirmed.

In all types the qualitative and quantitative estimation of urinary sodium chloride showed a diminution in the quantity excreted. The response to salt therapy was so rapid and definite that any anxiety about the actual or potential occurrence of an organic abdominal lesion was soon allayed.

The routine treatment adopted for patients of all three types was to put them to bed in Fowler's position (except those who were severely shocked), and record pulse, temperature, respiration and vomiting at two-hourly intervals. The degree of diminution of urinary chloride was assessed and checked quantitatively. A continuous intravenous drip of normal saline was started; the rate of flow depended on the degree of deficiency of salt and on the clinical state of the patient. If more than 1 litre of saline was indicated, the rate of flow for the second litre was maintained at 40 drops a minute. When the diagnosis was established Fowler's position was relaxed and salted fluids in calculated amounts were allowed by mouth until the quantitative estimation of a urinary specimen was more than 1 gramme sodium chloride per cent, or of the 24-hour specimen more than 10 grammes of sodium chloride a day.

During a period of excessively hot weather when *Australia* was closed up for three days in the action state, it was necessary for most of the ship's company to remain at their action stations continuously, except for a few short breaks. After the action a leading steward, 30 years old, who had been on duty in the after-control position on the lower deck, complained of nausea, anorexia, and dyspeptic symptoms. His work required him to lift heavy boxes from the storeroom on the platform deck to the main deck. The exertion made him sweat profusely. His symptoms had been present for about three months, but had become worse as a

result of excessive sweating when the ship was closed up. While carrying a tray the man suddenly collapsed with excruciating pain.

When examined in sick bay it was found that his abdomen was board-like and tender, particularly in the epigastrium in the midline. He had vomited ineffectively once since the onset of the pain, and the attack was accompanied by a moderate degree of shock. His mouth temperature was 98°, pulse rate 120 per minute but of good volume. He lay curled up on his side in bed and was immobile rather than restless. He resented any movement or palpation. A provisional diagnosis of perforated peptic ulcer was made. Routine examination of the urinary specimen showed no abnormal constituents, and an assessment of urinary chloride showed a second-degree diminution. Preparations were rapidly made for operation and as a pre-operative measure an intravenous saline drip was begun. About 200 cubic centimetres of normal saline were given before the patient was anaesthetised. It is worth noting that an injection of 1/4 grain morphine sulphate had given him no relief from pain; and his abdomen was still rigid and board-like. An incision was made under general anaesthetic but revealed no free fluid in the peritoneal cavity and no abnormality in the anterior gastric and duodenal surfaces or of the lesser and greater curvatures of the stomach, or of the pancreas, the gall bladder or the appendix. The abdomen was closed with a drainage tube into the lesser sac.

The post-operative period was uneventful. A continuous intravenous drip of glucose saline was given, augmented by rectal salines. The atmospheric conditions even in the sick bay were trying, and the patient's temperature rose to 102.8°F. on the second day after the operation. After 48 hours the tube, which had not drained, was removed and a graduated milk diet was started by mouth. The skin surface was kept sponged and cool, and in addition to the intravenous administration of saline, mildly salted fluid was allowed by mouth. In all, 5 litres of glucose saline were infused intravenously in the first two days. Improvement was then noticeable, but the qualitative assessment of urinary chloride still showed a first-degree diminution. It was not until the fourth day that a normal reaction was observed to the precipitation test. On the sixteenth day the patient was fit and well. He was then sent ashore for full investigation. A fractional test meal showed a mild hyperchlorhydria, but there was no radiological evidence of ulcer. Serum and cerebrospinal Wassermann reactions were negative, although the examination of the nervous system did not at any time suggest the diagnosis of a gastric crisis.

The case was most instructive, and as it occurred early in the series it emphasised the necessity for careful investigation and pre-operative salt therapy in cases of abdominal pain. There can be little doubt that the correct diagnosis was heat exhaustion with abdominal pain. The lifting of heavy weights vertically from the deck called for great strength of the abdominal muscles, and was responsible for the severe cramp-like contractions. The extreme irritability of muscles in cramp to palpation, and the persistence of the contraction, were very similar to the muscle rigidity

of a perforation. The urinary chloride assessment was instructive, but the improvement with such a small dose of saline (about 2 grammes) was not rapid enough to make diagnosis certain and so delay operation. In the light of subsequent cases at least 10 grammes of saline should have been given intravenously as a pre-operative measure.

There can be no doubt that cases have occurred in ships in the tropics where laparotomy has been performed and no perforation found. It is also known that in these cases salt was not exhibited, and attacks of similar pain occurred after the operation. Assessment of the urinary chloride both before and after operation is necessary in the tropics; when a surgical operation is performed under general anaesthesia, the sweating in the excitement stage, during and after the operation, is considerable, and the degree of salt depletion should always be checked.

Heat cramp is perhaps the most dramatic clinical manifestation of salt deficiency. The term is applied to the painful muscle spasms which may affect any striated muscle in the body. The muscles in most active use about the time of the attack are the ones most usually affected. Experience gained in Stening's series showed that the calf muscles (gastrocnemii), the ventral abdominal muscles, and the small muscles of the hands and fingers were most commonly affected by cramps. In *Australia* the incidence of heat cramp was relatively higher among stokers, who contended with a high working temperature in the boiler and engine-rooms as well as with high atmospheric temperatures. Intercurrent diseases appeared to play little part in increasing susceptibility to heat cramps, but gastro-intestinal disturbance (three cases in the series), causing increased loss of chlorides in vomiting and diarrhoea, may be a determining factor.

The severity of the cramps may vary within wide limits. Some patients may have only the intrinsic muscles of the hand and fingers involved. An intermittent painful cramp of the muscles of the calf of the leg may occur at night or after exercise. However, the picture presented by a patient in the throes of severe cramps of the abdominal muscles is striking. Severe paroxysms of intense pain lasting for one or two minutes recur every five to ten minutes. The contractions cannot be relaxed voluntarily and may spread from one muscle group to another or appear in many groups simultaneously. During the cramp the muscles are hard, and if the abdominal muscles are affected there is board-like rigidity of the abdomen. For some hours after a severe contraction there is a residual tenderness or dull ache in the muscle. The severity of the attack appears to depend on the degree of hypochloraemia, and not on the rate of loss of salt. The clinical and biochemical changes do not provide a full explanation for the occurrence of cramps but suggest that the lowering of the sodium and chloride in the body fluids is the principal causation mechanism.

The prevention of heat cramps entailed certain general measures and one specific prophylactic. A state of general good health, well-directed diet, facilities for work and restful sleep in a suitably cool environment, were the best general protection. In addition, during the first few days

of unduly hot weather, or in a sudden change from cool to hotter working conditions, muscular exertion was restricted and only gradually increased. The specific prophylactic was salt, which was taken regularly each day; the dosage was increased depending on activity, working conditions or degree of acclimatisation. In *Australia* all stokers were given 1 dram of salt when starting their watch, which meant that they took a minimum of 2 drams a day apart from what they had with meals. This was taken readily once the men realised how great an improvement it made in their well-being.

Ten patients were treated in the series for heat cramps, and they represented several aspects of the clinical state of salt deficiency: the classical form of "stoker's cramp" or severe abdominal cramp occurring characteristically in a stoker in the engine-room; the cramp of moderate degree developing in insufficiently acclimatised individuals or in patients in whom the loss of salt had occurred from other sources in addition to the skin; and lastly, the chronic form of mild isolated cramps affecting the muscles more frequently used during work and so simulating "occupational cramps", but actually arising from the cumulative loss of sodium chloride in small amounts over a long period. The following is the history of a patient suffering from "stoker's cramp".

A stoker petty officer aged 35 years complained while on duty in the forward engine-room of severe abdominal pains which made him double up and writhe on the deck. When examined in the sick bay he complained of intensely painful cramps over the whole of the anterior abdominal wall. He was sweating freely. Palpation of the abdomen showed that the whole of the ventral abdominal musculature, particularly the *rectus abdominis* muscles, felt as hard as stone. There was superficial tenderness associated with the contraction but no exact localisation of the tenderness. Mouth temperature was 97.4°F., and pulse rate 90 per minute and of good volume (systolic blood pressure 110 millimetres and diastolic 80 millimetres mercury). The urine showed no abnormal constituents, but assessment of the chloride indicated a second-degree diminution. Quantitative estimation was 0.3 gramme sodium chloride per cent. Atmospheric conditions in the forward engine-room were extremely oppressive. Moreover, the patient strongly opposed the consumption of extra salt in his engine-room, and had not himself taken the daily ration.

The response to treatment was dramatic. One litre of normal saline was infused intravenously, but complete relief from pain was noted after about ½ litre (5 grammes salt) had been given. Two drams of salt were then taken in 10 ounces of cold water without difficulty. The skin was dried and sponged, and electric fans were brought in to cool the atmosphere. After 24 hours the urine showed a second-degree diminution, and 5 grammes of sodium chloride had been excreted. The patient felt very well and was free from abdominal pain but had some residual tenderness of the muscles of the recti. After 48 hours' treatment the urine was assessed as normal with a daily excretion of 12 grammes sodium chloride.

After the attack the patient was strongly convinced of the need for salt in the engine-room.

Gastric symptoms rarely predominated in the clinical picture of salt-deficiency states, although symptoms of a minor gastric disturbance—impairment of appetite, nausea either before or after meals, and occasional postprandial vomiting—were frequent in the sub-clinical states. Occasionally, however, symptoms of a more pronounced gastric upset loomed so largely as the clinical feature that a gastric type was included in the classification of salt-deficiency states. This group fell into two types—the dyspeptic, and the vomiting or emetic type.

In the first of these the most constant complaint was a vague abdominal discomfort, without pain. The discomfort was aggravated by meals, even small quantities of food, particularly meat, producing a sensation of undue fullness. Nausea was usually felt after a meal, but vomiting was unusual. There was always a loss of appetite. The gastric symptoms were usually associated with other symptoms of the sub-clinical states of salt deficiency—headache, giddiness, weakness, lassitude and general lack of physical energy and mental alertness. At no time was the typical peptic ulcer syndrome closely simulated, and epigastric pain and tenderness were not features of this type. Investigation always showed a diminution in urinary chloride excretion, both qualitatively and quantitatively, and an absence of occult blood in the stools. The immediate improvement in well-being and the subsidence of the gastric symptoms with alkali-salt treatment was marked, and served in conjunction with the increased excretion of sodium chloride in the urine as a therapeutic aid to diagnosis.

It was common to find an increase in appetite for food during the early days of service at sea in the tropics, followed by a definite decline and eventually a loss of weight. The impairment of appetite, which probably resulted from decreased alimentary function, tended to improve with the development of acclimatisation, but at no time was the appetite as good in the tropics as in temperate or cold climates. A modification of appetite may mostly be regarded as an adaptive phenomenon; proteins and fats have less appeal in the hot climates, which is not surprising in view of the high calorific value of fat and the specific dynamic action of protein metabolism.

The vomiting or emetic type of gastric disturbance was less common and found mostly in men not yet acclimatised, who had recently joined their ship and were subjected to unusually trying conditions of heat, particularly if they were not fully alive to the importance of replacing adequately the salt lost in the sweat. Vomiting was a common symptom in other states of salt deficiency, but not as a rule the predominating one. Sudden and severe vomiting was the outstanding symptom of this clinical state; the attacks were not attended with nausea, were not always associated with meals, and frequently were repeated. They were accompanied by a feeling of faintness, weakness and impending collapse, sometimes by mild colicky pains, and also by moderately severe diarrhoea.

The abdomen was not usually tender; occasionally there was a slight fever with a disproportionately rapid pulse rate. In all cases urinary chloride estimations confirmed the diminished excretion of sodium chloride.

Apyrexial diarrhoeic type. After *Australia* had come from cold wintry weather in the North Sea to the sweltering heat of the Gulf of Aden, and before the importance of taking extra salt had been realised by the ship's company, there were 45 cases of diarrhoea due to salt deficiency. Almost all had very frequent watery motions unaccompanied by fever or pain. The stools were unformed and for the most part fluid, not offensive or abnormal in colour, and containing neither mucus nor blood, nor any other abnormality. The diarrhoea was often of a lienteric or postprandial nature, and the certainty of a bowel motion after a meal greatly lessened the desire for food, although the appetite was not impaired by nausea. The bowel appeared to be in an irritable phase with an excessive reflex response to food. Abdominal discomfort was often present but did not amount to pain. Mild tenesmus occurred in some patients, and the passage of frequent watery stools was sometimes followed by a feeling of exhaustion and faintness. Pyrexia was not seen in this series, and its absence was a notable feature. The subjective feelings of the sub-clinical states were usually present and included weakness, lassitude, headache, attacks of faintness and giddiness, and undue fatigue. The urine showed a first-degree or second-degree diminution in chlorides.

When salt was taken it passed almost unabsorbed through the stomach and small intestines, the absorption being mainly in the colon. Adequate therapeutic salt administration was effective. Patients in whom vomiting was associated with diarrhoea were given dilute hydrochloric acid in small doses of 15 minims in water three times a day, in consideration of the possibility of the diarrhoea being gastrogenous in origin from a temporary hypochlorhydria or achlorhydria from excessive loss of sodium chloride from the body.

Stening suggested that the diarrhoea (and in some cases the vomiting) might be caused by irritation of the smooth muscle of the gastro-intestinal tract by a process similar to that causing cramps in striated muscles. The treatment for this type was almost exclusively salt replacement. Salt was given in large doses by mouth either as a powder or in a tablet. If it was not tolerated by mouth, an intravenous infusion of 1 litre of 5 per cent glucose in normal saline was given and repeated if necessary. The response was ready, and a forming of the stool and slowing of the frequency of bowel actions was noticed within 12 hours.

The vomiting-diarrhoea-pyrexial type was instructive, and included most of the symptoms and signs of the salt-deficiency states. The overlapping of symptoms and the merging of the clinical picture were most pronounced.

The prodromal phase included the symptoms of the sub-clinical state of salt deficiency, more particularly weakness and lethargy, headaches and giddiness. Vomiting usually occurred before the onset of diarrhoea and made its appearance suddenly and unexpectedly. Both vomiting and diarrhoea developed rapidly and caused a considerable loss of fluid and further loss of sodium chloride. A condition of mild shock was usually present. There were also abdominal pains, vaguely localised and of a mild cramp-like or colicky nature. There were no cases with well-developed muscular cramps. In association with the vomiting and diarrhoea, the outstanding aspect of this subgroup was the rise in body temperature, to a limit of 103.5°. This was accompanied by a dry, pungent skin. The stimulation of a skin reaction with the onset of sweating caused a lowering of temperature, relief of headache, and a general improvement.

In all cases the excretion of chloride in the urine was low and the response to supplementary salt therapy ready. Local measures to keep the body temperature below 102 degrees were taken in addition to the administration of salt.

Incipient heat-stroke. The pyrexial type of salt deficiency, which was regarded as a precursor of heat-stroke proper, was not commonly encountered; only five patients in Stening's series recorded a temperature higher than 104°F. A raised body temperature was justifiably regarded as a danger sign in all salt-deficiency states. The factor of impairment or absence of normal sweating occurred in the pyrexial type and in heat-stroke, in addition to the salt depletion of the body which is the pathological basis of all the clinical states of salt deficiency.

There appears to be no distinct line between severe heat exhaustion and heat-stroke. In fact the term hyperpyrexia would be a much more accurate one than heat-stroke. Heat exhaustion cases will, if untreated, pass on to hyperpyrexia, and once the temperature reaches very high levels—107° to 108°—with accompanying coma or convulsions, the clinical picture is that of hyperpyrexia, although the essential pathology is the same.

How hypochloraemia interferes with sweating was not known. It was suggested that the sweat glands were unable to secrete sweat when the concentration of sodium chloride in the blood was low; or alternatively that a low sodium level induced a secondary reduction in blood volume, as it was generally accepted that shrinkage of blood volume depressed sweating. However, it was evident that hypochloraemia gravely embarrassed all the normal metabolic functions of the body, apart from the fact that it interfered with sweating. Adaptation to high temperature involves an increased capacity to produce sweat, a greater sensitivity of the temperature-regulating apparatus, and an economy of salt excretion. The effectiveness of adaptation varies from one person to another.

In a state of shock, a hot-water bag applied to a cold part of the body surface warms more rapidly and to a greater degree than in health. This observation was of the greatest importance in interpreting the

phenomenon of hyperpyrexia, and demonstrated clearly how severely the temperature-regulating function of the skin was impaired as a result of peripheral circulatory failure. The body of a severely dechlorinated patient in a state of oligaemic circulatory failure characteristic of severe heat shock, would probably react in a similar manner to high environmental temperature if the protective cooling of the sweat secretion was interfered with, the metabolic functions of the body upset, and the delicate adjustment and coordination of the temperature-regulating mechanism disturbed.

The onset of heat hyperpyrexia may be sudden with a rapid, unheralded rise of temperature. In most cases it is preceded by various sub-clinical signs of salt deficiency. Important prodromal signs of the development of hyperpyrexia in a patient with a low-grade pyrexia are dryness of the skin, photophobia associated with sunken and tender eyeballs, tinglings and numbness in the hands and feet, and mild cramp-like feelings in the muscles of the limbs. The pulse is quickened and may become irregular in time and amplitude; the headache becomes worse and the patient may be mildly confused and very restless. When the sudden rise in temperature occurs the skin becomes hot and pungent and the face flushed, with bright eyes and moderate congestion of the conjunctiva. The patient who has developed a fever exceeding 108° should be treated without more than a minute's delay. It is important to reduce the temperature quickly to a safe level and maintain it there, and to replace the salt deficiency.

The most efficacious way of reducing body temperature was found to be by spraying the patient with cold water and using fans to supply a free current of air. The patient was stripped of clothing and laid on a sheeted bed so that as much air as possible could flow round the body; cold water was then sprayed or sponged on and the air was kept circulating. When the temperature had fallen below 102° this treatment was suspended, and when a relapse seemed unlikely the patient was given salty fluids to drink: half a dram of salt in half a pint of water every half hour. If sweating occurred the prognosis was good. Severely dechlorinated patients required large amounts of salt. Relapse was guarded against by prescribing a routine daily dose of common salt.

Heat-stroke proper, or hyperpyrexia. The predisposing factors in heat-stroke are both internal and external: deficient fluid, or more particularly deficient salted fluid intake, and very high atmospheric temperatures with high relative humidity and stagnant air. Contributing factors are the fever of an intercurrent disease, unsuitable clothing, and unhygienic living conditions. The classical type of heat-stroke occurred when muscular exertion was performed in a high environmental temperature beyond the stage of fatigue or even of exhaustion. The patient collapsed, apparently moribund, with fixed stare, contracted pupils, shallow breathing, imperceptible pulse, and deep cyanosis. Cessation of sweating was the danger sign in these cases, and then came the sudden rise in temperature. Coma, convulsions, vomiting and diarrhoea sometimes accompanied the high temperature. More rarely encountered was the psychopathic form,

in which the mental balance was upset and the patient became confused, excited, and even violent. Death could usually be avoided if the patient was treated promptly and effectively. The depth of coma, the rapidity of regaining consciousness, and the response to temperature-reduction measures were guides to prognosis.

The mortality from hyperpyrexia was high in the ships of Allied navies serving in the tropics. In the Australian Navy the occurrence of hyperpyrexia was rare but two cases were recorded, both of them fatal. In June 1940 a stoker in *Hobart,* which was then in the Red Sea area, was brought to the sick bay, breathing stertorously and in a comatose condition; his complexion was florid, but there was no cyanosis. He was diagnosed as suffering from heat-stroke, and was treated with an ice pack, followed by an iced enema. He did not react favourably, and artificial respiration was applied and preparations made for intracardiac injection of adrenalin, but before this could be administered the heart stopped beating. In the next month while *Hobart* was still in the Red Sea area a telegraphist on whom a dental operation had been performed was put in the sick bay and kept under observation by the sick-berth staff. The sick bay was extremely hot, as it had been closed down for "Action Stations", but the patient's condition appeared satisfactory, and he began to regain consciousness. An hour later, however, he was cyanotic and no respiration was apparent. His axillary temperature was too high to be recorded on the clinical thermometer, and although treatment was begun at once, he did not recover. As a dental operation had been performed, an X-ray examination of the chest of the body was carried out. It showed no evidence of a foreign body or of pulmonary collapse and the cause of death was given as hyperpyrexia.

CHAPTER 10

BURNS

THE high proportion of burns in relation to other action casualties in the navy fixed attention on the subject, with the result that a number of advances in prophylaxis and treatment were made during the war years. Surgeon Rear-Admiral L. Lockwood, in reviewing the evolution of prophylactic methods, noted the changes which occurred. During the fighting in Greece and Crete in the first half of 1941 the wearing of protective clothing was not enforced. The white tropical rig gave little protection against flash and blast, and much invalidity was caused, not to speak of loss of life. Similar conditions obtained in Singapore and Java. By the second half of the war, however, when Australia's naval effort was concentrated in the Pacific, protective methods were becoming standardised.

Ordinary clothing, if it covered the body adequately, was in itself a partial barrier against heat and flame. In January 1941 during an air raid on Malta H.M.T. *Essex* was hit by bombs and a medical party from *Perth* was sent over with first-aid bags and haversacks. The injuries treated comprised flash and blast lesions, which varied in severity according to the degree of protection available. It was seen that parts of the body that were completely uncovered, such as the face and the hands, or the feet from which loose-fitting shoes or slippers could easily be blasted off, suffered considerably and sections of the skin were lifted off in sheets. Even the thinnest material lessened to some extent the intensity of a flash burn, but flash could pass through or under light loose material, and thick, tightly-fitting clothing was a more effective protection.

The value of protective clothing was emphasised when a medical party from *Hobart* went to the aid of the crowded transport *Georgic,* which was attacked by dive bombers and set on fire in the Gulf of Suez on the night of 13th July 1941. Surgeon Commander Lockwood, accompanied by S.B.A. Bruce Phillips, took the pinnace into which were loaded the field valise, first-aid bag, a plentiful supply of morphia, material for the routine treatment of burns, several straight splints and two Neil Robertson stretchers.

> The merchant ship was already burning fiercely and was an awe-inspiring sight (wrote Lockwood). The pinnace came up under the forecastle of the ship, where a number of lascars were sliding down ropes, too frightened to take the final plunge into the water, and stubbornly holding on the ends of the ropes. Some of these lascars were treated for rope burns with "Tannafax".
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> At about 0330 a tender came alongside and activities were transferred to her. The saloon was used as a medical station; the ship's surgeon had been injured, [and] treatment of the casualties began at once. A number of these appeared in the saloon and a brief glance showed that most of the cases were severe burns. Most of the burns were caused instantaneously by the flash of the bomb; but others were due to people escaping through the flames of the burning decks to safety. Those who escaped informed me that the smoke caused choking and made escape difficult.

The first thing done was to administer a hypodermic injection of morphine sulphate grains one third. The effect was dramatic, and the look of gratitude on the faces of those severely burned will never be forgotten.

It is worthy of mention that in all cases it was only the exposed portions of the body which were affected by the bomb flash; in other words, those areas of the skin which were covered, even if only by very thin clothing, were not affected by the flash and showed no evidence of burning.

Some of the cases, who at the time of the raid were wearing shorts only, suffered very extensive burns. After the morphia injection had eased the pain and mental anxiety, orders were given for the administration of hot sweetened tea, and this was relished by all burned patients.

The first-aid treatment of burns has been for long a very vexed question, and there are many opinions existing as to the best treatment under the stress of emergency. The large blisters were opened and raised-up skin removed. Much of the skin was charred and blackened, the char being driven into the deeper layers of the skin. It was impossible to deal with this problem. After removal of the blistered skin, some of the burns were dressed with "Tannafax" ointment applied to the smooth side of lint, while in other cases lint soaked in a solution of tannic acid two and a half per cent and acriflavine one in a thousand was used. A large quantity of tannic acid and lint was necessary, and it was fortunate that a large supply was already available in the field valise and first-aid bags.

About 0430 Surgeon Lieutenant Milroy and Sick-Berth Attendant Kain, O.N.22629, arrived to assist with the treatment and their appearance was very welcome, as there was much work to be done. The bravery of the wounded was very impressive, particularly of the engine-room personnel.

Two of the cases were brought back to H.M.A.S. *Hobart* when the medical party returned at 0600, exhausted but happy to have been of some use. One case, the ship's barman, a fat man of 64, was suffering from multiple burns of the face, arms and chest. He was very shocked, with a pulse of 100. Morphine sulphate grains one third was given, together with fluids and he was kept warm in bed. All dirt, loose skin and blisters were removed, and the affected areas sprayed with acriflavine and tannic acid solution. (No triple dye was then available.) A very good tan soon developed, and the patient's condition soon improved. The other case, a lascar, had his right hand removed at the wrist due to a high explosive fragment. Arterial haemorrhage was arrested with a tourniquet and morphine sulphate grains one third given. Both these cases were discharged to the local military hospital later in the day.

Hobart, when en route to Batavia, rescued most of the survivors of another ship which had been set on fire by enemy aircraft. This was the *Norah Moller,* which was attacked in Banka Strait on 3rd February 1942. Of those taken on board, 30 were suffering from wounds, mostly severe burns, and they were treated by Surgeon-Commander Lockwood and Surgeon-Lieutenant Milroy. There were six deaths in the ship. Two of the men who died had bomb-splinter wounds in addition to multiple burns. In one case an intravenous injection of blood plasma was attempted but because of circulatory collapse and the extensive area burnt this was unsuccessful. The other burns cases were treated in Hobart by the triple dye method, which proved most satisfactory. When *Hobart* reached Tanjong Priok on the 4th the remaining survivors were transferred to a civil hospital, where two more of the burnt men died as well as three with blast injuries. However, nineteen recovered, and of these some had had very severe and extensive burns.

In naval ships there was a disinclination to wear full battledress—long whites or overalls—because it was hot, and some men even regarded it as effeminate. These prejudices, however, gradually disappeared as casualties became more frequent and it was realised how much more severe were injuries to exposed parts of the body. A sick-berth attendant in H.M.A.S. *Bendigo*—one of the ships which went to the help of *Empress of Asia* when she was set on fire by Japanese bombers while entering Singapore harbour—recorded that members of the crew were greatly impressed with the value of covering the body after they had seen a survivor who had nearly all the skin burnt off his arms, legs and abdomen by flash.

Special anti-flash gear worn with protective clothing could very often prevent, or at least greatly mitigate, the severity of burns. It was necessary that it should be donned at the first degree of readiness or when air raid warnings sounded. As the flash occurred in a split second, it was too late to put it on after the bombs had fallen. The type of anti-flash gear originally issued was too complicated to be put on in a hurry. Surgeon Commander C. A. Downward, who was in *Canberra* when she was sunk in August 1942, reported that very few men had time to get into their gear. One man who was wearing his had the fastenings torn off by the first blast, and was then burnt by a later blast. It was subsequently recommended that the gear should consist of an overall with a wide belt containing compartments for small articles of medical equipment, and a hood or cowl attached which could be quickly drawn over the head and adjusted. Very strong fastenings, zips for example, were necessary.

Numbers of men who suffered severe burns when *Australia* was attacked by *kamikaze* aircraft off Leyte in October 1944 were finally evacuated to Sydney in U.S.S. *Calamares*. Surgeon Lieutenant G. L. Grove escorted them, and he took the opportunity to investigate the relationship between the degree of burning suffered and the type and amount of protective clothing worn at the time of injury. He recorded: whether anti-flash gear had been worn; whether it had been discarded and, if so, at what stage; whether the gear had been washed and, if so, how many times; and whether it had been reproofed. More than 40 men were examined for the purpose of this study, the information obtained being correlated with the burns inflicted and their severity. There were, of course, many variables to be considered. In some instances the anti-flash gear only smouldered, while the battledress burned freely; prompt removal of burning gloves or anti-flash hood also affected the condition of injury. Analysis of the results of this inquiry produced a number of observations and suggestions. In general, it was found that anti-flash hoods and/or gloves, proofed and not washed, afforded satisfactory protection to the parts which were covered. Some protection was also afforded by unproofed gear, varying with the nature of the material. It was suggested that in future the trouser legs of the battledress should be tucked into socks, that instead of shoes boots should be worn as they gave better

protection and were not so easily dislodged, and that the reproofing of flash gear after washing should be compulsory. Incidentally, no instructions had been issued in *Australia* for reproofing anti-flash gear after washing, and no borax or boracic acid had been available for the purpose.

Many men stated that they could not use anti-flash gloves because of the nature of their work—for instance, turning the dials of director equipment, or using signalling pads. It was suggested therefore that mittens, with the tips of the thumb and the index and middle fingers missing, should be issued to allow fine work to be carried out without exposing the whole of the hands. Alternatively, they should be allowed to cut away those parts of their existing anti-flash gloves.

The whole question of prophylaxis of burns was worth pursuing, even though it was difficult to impart more than a modified degree of protection.

During the 1914-18 War treatment had been mainly by "Vaseline" and gauze, or *tulle gras,* methods. After that war tanning and dyeing were introduced: tannic acid, silver nitrate, and the dyes gentian violet, brilliant green and acriflavine. The simplicity of using triple dye made it invaluable for the treatment of large numbers of burns in the cramped and unstable conditions on board ship. Its disadvantage lay in the risk of scarring of the face, hands and extremities, and of causing circulatory obstruction and necrosis, but these *sequelae* were extremely rare. An early mistake, as Lockwood records, was that of cleaning the burned surface too severely and of removing too much loose skin and so tending to "skin patients like rabbits". Such measures greatly increased shock.

When multiple electrical burns were suffered by a crew member of H.M.A.S. *Swan* in December 1940 the wounds had no feeling at first and scrubbing with ether soap caused no pain. "Tannafax" was then applied and covered with dry dressings. By the tenth day all crusts had been removed, and punched-out craters were left in the flesh with some slough at the bases. These were treated with saline baths and *unguentum hydrargyri oxidi flavi dilutum.* With constant treatment, and at a late stage cleansing with hydrogen pyroxide and aqueous acriflavine 1 in 1,000, the burns gradually healed by granulation. There was a good deal of scarring, and it was thought that complete healing would not occur for several months.

Again in June 1942 Surgeon Lieutenant S. A. C. Watson recorded the case of a rating in *Nestor* with extensive first-degree and second-degree burns of feet, thighs and buttocks, and less severe burns of the back, neck, face and arms, caused by hot water being splashed over him when a bomb burst opposite the galley where he was working. He was treated immediately with large doses of morphine and tannic acid jelly, warmth and fluids. When he had recovered from shock the burnt areas were scrubbed, under anaesthetic, with ether soap and spirit, and tanned with 15 per cent fresh tannic acid solution, but they could not be dried properly because there were no fans or lights. Areas which were wrapped in gauze soaked in tannic acid did not heal as well as other parts and

later became painful and infected. After he had been transferred to H.M.S. *Javelin* he was transfused with 600 cubic centimetres of plasma, and lights and a cradle were rigged for drying the tan. His condition was then fairly good.

In October 1944, when *Australia* was damaged in the action off Leyte and many burns were suffered, tannic acid was no longer being used. By then treatment had been standardised to immediate injection of ½ grain of morphia, with further injections as indicated; replacement of fluid loss by intravenous plasma or by mouth, depending on the severity of the loss and the general condition of the patient. Dead tissue was then cleared away, the area was dusted with sulphanilamide powder, and *tulle gras* or sterile "Vaseline" was applied with a fairly firm bandage unless pain or suspicion of sepsis was encountered.[1] It was noticed that morphinised patients were often restless enough to disarrange dressings though they suffered no pain. Penicillin was administered parenterally in all cases of serious surgical wounds. A general anaesthetic, which could be fatal to badly burned patients, was given only as a last resort. Morphine was valuable for relieving anxiety as well as pain. It was conveniently administered by a hypodermic syringe from a standard solution containing 1/6 grain in 5 minims of sterile water.

It is interesting to note that the wheel of time had made a full turn, bringing a reversion to the simple gauze and petrolatum method and its variants. The custom in U.S. destroyers was to dust on sulphathiazole powder, then cover with *tulle gras* and give sulphathiazole by mouth. Saline pressure dressings were no longer used.

The renewal of dressings still presented considerable problems. Conditions in fighting ships were such that medical personnel had neither the time, the space nor the facilities to give constant care to the wounded. Moreover, it was not desirable to disturb badly shocked patients more than was absolutely necessary. Seven of the burns cases who were transferred from *Australia* to the hospital at Manus and then to U.S.S. *Calamares* for passage to Sydney were in a very bad condition. Their state of shock had been aggravated first by being moved to Manus and then by being embarked on *Calamares*. At Manus the staff of the base hospital had been overwhelmed with casualties from the Philippines; they had given the patients sulphanilamide locally and orally, but had been unable to give individual attention to dressings, so that by 1st November most of the men were wearing the original dressings which had been applied on 21st October; these were soaked in pus and in two cases infested with maggots. Grove, who accompanied the patients, reported that three of them were lying literally in pools of foul-smelling pus, which caused extreme pain and discomfort. On board *Calamares* treatment followed the routines carried out in *Australia*. In addition, doses of sedative and analgesic drugs were given sufficient to ensure sleep at night. Morphine was

[1] Surgeon Lieutenant A. H. Robertson of HMAS *Arunta*, writing in June 1942, records that the de Vilbiss sprays supplied for sulphanilamide powder were unsatisfactory in damp climates. "Sal Vital" tins with perforated lids, and sealed over with cellophane to keep them in good sprinkling condition, made excellent substitutes.

administered in liberal doses before carrying out painful dressings. Where large areas were burnt it was considered advisable to give sulphanilamide orally as well as locally, because of the risk of toxic effects from absorption. In these cases a three-day course of penicillin was given parenterally, with dramatic results.

During the passage in *Calamares* trial was made of detergents to help in the removal of sloughs. Two preparations were used. The first, "Hypex", was an American proprietary preparation described as a detergent emulsion. Gauze soaked in "Hypex" was applied to the burnt area and left for 48 hours; one or two applications usually left a clean raw area which granulated rapidly. The drawback was that even when kept moist the dressing tended to stick, and its removal caused some pain. Grove thought an Australian ointment suggested by Surgeon Lieut-Commander D. A. Warden more effective. It contained: zinc oxide grs xxx, calamin praecip min xxv, ol terebinth min xv, yellow "Vaseline" ad 1 oz. This was smeared on lint and left on the affected area for 24 to 48 hours. It did not stick, and one application usually left a clean area which was then treated with sulphanilamide powder and "Vaseline" gauze. On arrival at their destination, Sydney, most of the men were progressing well and bare areas were rapidly nearing the favourable stage for grafting where necessary.

When *Australia* was damaged again by *kamikaze* aircraft in the Lingayen Gulf in January 1945 there were further burns casualties. Surgeon Commander J. M. Flattery commented that the previous action had pointed to the necessity for having quantities of sterile "Vaseline" gauze ready for use in large containers distributed to all action stations. He estimated 50 pounds of gauze to be the minimum requirement for a heavy cruiser. It was found in *Arunta* that pom-pom ammunition boxes were ideal as containers for the gauze and sulphanilamide: they were a convenient shape, and being heavy did not slide about easily in rough weather. Large, wide bottles were more commonly used as containers.

The special topic of phosphorus deserves brief consideration. These burns were due to injuries from incendiary bombs, or from explosive bullets containing phosphorus. In the latter instance it was well to consider phosphorus burns as a complication of a machine-gun attack from the air.

First-aid treatment was outlined in a navy technical instruction, which directed that the affected part should be kept thoroughly wet by immersion in water or by constant wetting with a thick pad. The addition of soda bicarbonate or carbonate to the water was desirable, but oils or dyes were strictly excluded. Cases of suspected phosphorus burns were wisely regarded as needing urgent care. Further treatment consisted of removing all particles of phosphorus under water; it was simpler to detect them in the dark. Prolonged immersion in an alkaline solution was continued till all traces of phosphorus had disappeared.

An alternative method employed one per cent copper sulphate. The part was immersed in this solution and copper phosphide was removed, preferably with an antiseptic such as boric acid. Further treatment followed the usual lines for ordinary burns.

Of all the lessons learnt in the therapy of burns perhaps the most important was the necessity for treating the condition of shock. That this had been recognised is shown by the instruction given to medical parties in H.M.A.S. *Adelaide* in March 1943. This read: "No local application should be made. Treat at once for shock."

Because the navy had to treat a much higher proportion of burns than of wounds, there was more need for blood products and substitutes, particularly of plasma and serum, than for whole blood. In Australia and overseas the R.A.N. was dependent on supplies from army blood and serum preparation units, which mainly supplied whole blood and serum. British and American sources supplied plasma, which could be kept up to six months or longer at room temperature, or for years if frozen hard and stored.

The method of preparing, storing and administering liquid plasma recommended by the 64th British General Hospital, Alexandria, was as follows. Plasma was decanted from blood that had been drawn three or four days before into an anti-coagulant solution of 80 c.cm. of 3.8 per cent sodium citrate with 0.5 per cent glucose for each 460 c.cm. of blood. An outstanding feature of this method was that when the plasma was decanted 1/10th per cent sulphanilamide to 1 part in 100 of normal saline was added to give a concentration of 1/1,000th sulphanilamide in plasma. The solution then had a total crystalloid content of 23.5 per cent and a 75.5 per cent content of plasma. The addition of sulphanilamide served two purposes: it exercised a powerful protective action against bacterial contamination, which appeared to be effective for the vast majority of common contaminants; and it helped the prophylaxis of wound or burn infection. A patient receiving 2 litres of plasma would receive 2 grammes of sulphanilamide intravenously, which was well within the limits of safe dosage.

The plasma could be stored in three ways:

(1) In an ordinary domestic refrigerator at 30 to 40°F., where it could be kept safely for two years or even longer.
(2) Frozen solid at 18°F. (for example in the refrigerator of a meat storage plant). This was ideal, and the plasma would keep for several years under such conditions.
(3) At room temperature, where it could be kept for six months or perhaps longer.

The period of storage was limited only by the onset of protein denaturation, which rendered the plasma unsuitable for use. Little was known about the stage at which denaturation took place, but the process was a slow one, particularly at refrigeration temperatures. When decanted, the plasma was not a clear fluid, and a cloud of lipoids would gradually rise

to the top and a mat of debris fall to the bottom. When fresh, the plasma in between was translucent; any cloudiness that developed could be due to the formation of fibrin clots, or to infection. The smell was a fairly reliable guide to the condition of the fluid: contaminated plasma smells, but sterile plasma is odourless. Doubtful bottles were returned for examination.

Before transfusion, the plasma was passed through four to eight thicknesses of sterile gauze to remove the gross debris that would otherwise block the apparatus. The Middle East giving set (Dakin's funnel and Laurie's drip counter) and a glass funnel covered with gauze to serve as a filter, were suitable for administering the plasma, which was given at body temperature.

Further details about transfusion are given in Volume I of this history; it will be noted that the techniques employed could differ considerably without there being any loss of efficiency. The indications for transfusion differed in no essential on ships. Oligaemic shock was the chief indication, but the use of plasma or serum to replace the body fluid lost by seriously burnt patients was an important aspect about which much was learnt by experience. It was stressed that first-aid measures should be carried out promptly, and sources of internal bleeding looked for.

It is recorded by H.M.S. *Formidable,* which suffered considerably from *kamikaze* attacks towards the end of the war, that when large quantities of plasma were given immediately to burn patients, even quite serious burns were dry within 48 hours. If transfusion was delayed the patient's plasma was greatly reduced by oozing from the damaged capillaries; the remaining plasma was diluted, and this watery plasma passed readily through the capillaries, thus increasing the amount of oozing. When large amounts of plasma or serum were administered, the osmotic pressure was increased and the oozing reduced. The capillaries quickly recovered their tone, and the damaged area was able to heal. The longer transfusion was delayed, the slower the time of recovery.

The relative merits of liquid and dried plasma were often debated. Surgeon Commander Downward was greatly in favour of dried plasma, which was widely used in the American Navy, usually in the form of "Lyovac" (rapidly lyophilized normal human plasma). Each unit was in a cardboard box containing one "vacule" ampoule which would yield 250 c.cm. of reconstituted plasma, one vial containing 250 c.cm. of pyrogen-free distilled water, and a complete giving set. The ampoule containing the dried plasma had a vacuum inside, so that the distilled water flowed in readily, and easily dissolved the plasma. Some of the advantages of dried plasma over liquid were:

(1) It could be kept for much longer—up to four or five years.
(2) It was completely sterile. There were no flocculent deposits, discolouration, turbidity, or other signs of deterioration such as may be found in wet plasma.
(3) It could be kept in all parts of the ship ready for an emergency because it did not require cold storage, though it needed to be kept in a cool place. It did not, therefore, need to be warmed before it was administered.

(4) Filtration was not necessary, because there was no turbidity and no flocculent precipitates to stop the flow. A slow process, which consumed valuable time, was thus avoided.

This enthusiasm for dried plasma was not shared by the Director of Naval Medical Services, Surgeon Captain Carr, who considered that liquid plasma or serum was quite as good as, and possibly better than, the dried. One disadvantage of the dried plasma was that it took up more weight and space than the wet, because distilled water (or sterile saline) for reconstituting it had to be carried in a separate bottle.

The transfusion of plasma for burns was extremely effective. A member of the crew of the United States destroyer *Brooke,* which had been attacked by a Japanese suicide plane, had two-thirds of his body surface burnt. He was transferred to *Warramunga* and given seven units of plasma and two of dextrose saline. He made a good recovery. Seven burn casualties from H.M.A.S. *Australia,* which had occurred during the action in Leyte Gulf, were given plasma on the ship and again at Manus six days later. In only one case was a further transfusion necessary, and the whole blood was given when he arrived in Sydney.

One very real problem in the Pacific theatre was to make sure that the vessel carried adequate stocks of plasma to meet repeated emergencies. In the northern hemisphere it was relatively easy for a ship to return to base after an action, replenish its supplies and put the sick and wounded into hospitals. The long distances of the Pacific militated against this, and the British Pacific Fleet in particular found it necessary to revise its methods and procedures considerably to meet the changed conditions of warfare. For instance, the standard issue of plasma to aircraft carriers was one bottle to every 10 men. When H.M.S. *Formidable* was subjected to repeated attacks by *kamikaze* aircraft the carrier's stock of 200 bottles (which was well above the standard issue) was almost used up after the first attack; the need for more plasma after the second attack was truly desperate. It was suggested that 1,000 bottles to each carrier would be ideal.

CHAPTER 11

BLAST INJURIES AND POISONING BY FUMES

THE clinical effects of blast could usually be explained in terms of the positive (compression) and negative (rarefaction) phases of a wave caused by an explosion. While most of these effects were capable of simple explanation, some of the observed phenomena were curious.

The effects of aerial blast were notably capricious, owing no doubt to the labile and compressible nature of the medium in which we live and breathe. The front of an advancing wave was often irregular, so too were its effects. It could be readily understood that the caprice of aerial blast might produce less severe damage in persons blown into the water by a bomb explosion than in those affected by submarine blast. The power unleashed by the underwater explosion of a depth-charge might be sufficient to erupt a vast column of water with such violence that the effect would be communicated to the hulls of ships two or three miles distant. In April 1941 during the evacuation of Greece a merchant ship anchored in Piraeus just ahead of *Perth* was hit and sank in a few minutes. Some of the survivors were suffering from bomb blast and it was noted that those who had actually been blown into the water did not suffer severe injury. On the other hand, when *Perth* was torpedoed many men who were already in the water were killed by blast when the ship was hit again: one succumbed to a ruptured viscus which could not be treated.

Chest injuries due to aerial blast were not uncommon and were explained by the nature of the thoracic cage whose response to powerful waves of compression and rarefaction made damage to the lungs possible. The multiple lung injuries found after fatal cases of blast might resemble those occasionally seen after accidents where a severe fall or violent propulsion of the body had occurred. Aerial blast gave rise to severe shock, pain, restlessness, difficulty in breathing and cyanosis, with underlying lesions of patchy haemorrhage and consolidation. Visceral bleeding also occurred in the abdominal organs when these were affected by blast, and sanious diarrhoea and haematemesis might appear. These were often accompanied by haemoptysis.

Thoracic injury after underwater blast was less common than after aerial bombing: abdominal injury occurred more frequently, probably owing to the lack of protection afforded by the abdominal wall when exposed to the violent thrust communicated to the water by the force of the explosion. A life-jacket gave more protection to the thorax than to the abdomen, but a certain amount of damage might be done to the bases of the lungs through the transmission of explosive force from the abdomen to the diaphragm leaflets and thence to the lungs. This mechanism might suggest the co-existence of abdominal injury also when there were signs of pulmonary injury. Some protection could be afforded to the abdominal organs of persons surviving the sinking of a ship subjected

to submarine explosion, provided they swam or floated on the back, thus saving the abdomen from the impact.

Abdominal blast caused bleeding under the serous coat of the organs, and severe damage might cause deeper lesions. Immediate treatment was for shock, morphine and oxygen being of particular value. Different types and degrees of severity in abdominal blast were recognised. In the least severe forms pain and rigidity would perhaps be the only obvious signs for several days, but bleeding from bowel or urethra might indicate more severe injury, and this could be followed by contusion or abscess. Perforation of hollow organs might be manifest early, and if unrelieved would be rapidly lethal. The question of laparotomy had to be decided by these signs, but it was found unwise to defer decision until the issue was clear: such clarity was only too often attended by dangerous risk. It was pointed out that signs confined to the upper part of the abdomen might be caused by a chest injury, but when these spread to the abdomen a severe abdominal lesion was highly probable. Signs confined to the abdomen from an early stage were usually associated with a fatal injury.

Surgeon Commander C. Keating, R.N., who contributed an article to a joint discussion on blast injuries, pointed out that combined intra-abdominal and intra-thoracic injury often occurred, and that basal pulmonary damage was accompanied by a brief relaxation of the abdominal muscles at the end of the expiratory phase. Patients suffering from the effects of immersion blast described sudden pain in the back, often with a sensation of constriction and numbness of the lower limbs which might make self help difficult.[1]

Naturally there was a wide disparity of symptoms, ranging from those of severe shock and pain, due to multiple vascular or visceral injuries, to milder manifestations caused by intra-mural bleeding in the hollow organs. The misleading period between injury and the signs of peritonitis needed special emphasis. It was well illustrated by an experience of the medical officers of *Hobart,* who in February 1942, as mentioned, treated survivors from the British ship *Norah Moller,* which had been attacked by bombers.

In describing the incident, Surgeon Commander L. Lockwood wrote:

> Another type of injury dealt with was due to the effect of blast at the time of bombing. Two cases received the blast injury while in the bombed ship; the third was stated to have been injured by the compression wave in the water after having jumped overboard, due to a bomb bursting in the water not very far away. At first sight this type of the injured does not appear to be very ill. The patient complains of some pain and discomfort in the abdomen; one had a moderate degree of haematemesis. A characteristic feature of all three was their inability to micturate; all had to be catheterized. Abdominal rigidity did not develop until some hours after admission to hospital next day, that is until at least twenty-four hours after receipt of the injury. What made things more difficult was the fact that all three cases were Chinese and could not speak any English.
>
> When abdominal rigidity developed, Professor Reddinghuis (of the Central Civic Hospital, Batavia) at once operated. Two cases were found each to have a rupture of the ileum; in the third the sigmoid colon was ruptured. In the latter case a

[1] *Medical Journal of Australia,* 18 Aug 1945.

left sided colostomy was performed. The first two cases were found to have large tears of the ileum; owing to their shocked condition resection and anastomosis were inadvisable, and exteriorisation of the affected loop of ileum was performed in each case; that is, the ruptured segment of bowel was brought outside the abdominal wall and sutured to the peritoneum. After the patients had recovered from the initial shock and their general condition improved, it was proposed to resect an appropriate amount of small intestine. In the case of the sigmoid colon lesion, it was hoped that this would heal and that later the colostomy could be closed. However, all three cases died, and autopsy showed that in each general peritonitis had developed.

The combination of severe burns with blast injuries undoubtedly increases the hazard very greatly.

In July 1943 *Hobart* herself was torpedoed, and there were many cases of blast injury among her crew. Surgeon Lieutenant R. M. MacIntosh recorded that he was in the wardroom when the torpedo struck the ship. After a time he became conscious that he was in water up to the knees and that wreckage restricted movement. He was undoubtedly suffering from the effects of blast concussion, but managed to escape by the quarterdeck and eventually reached the sick bay, where the injured were being given preliminary treatment by the sick-bay petty officer. The commonest type of injury was that due to blast effect, with concussion or shock. Some patients who were badly shocked were treated with morphine, warmth and intravenous serum, and half-hourly charts were kept. *Hobart* reached port about 38 hours after the attack and the injured were landed at an American naval hospital; their subsequent progress was satisfactory.

Blast injuries of the brain were perhaps responsible for more damage than was realised, as structural changes might exist unsuspected in the central nervous system of persons dying as the result of bomb explosions. Lesser grades of the same type of damage fell into the sphere of the neurological surgeon, and explorations revealed lesions only detected by careful study of the peripheral effects. Surgeon Captain L. C. Rogers, consultant in neurosurgery to the Royal Navy, referred to the curious apathy and dejection of some patients who were blown up by the force of an explosion. The pathological lesions in the brain were usually vascular in type, due apparently to leakage from blood vessels with possible sequels of more serious damage occurring later. It did not follow, however, that apathy and depression were always due to demonstrable lesions. The National Research Council, Washington, D.C., investigated the nature and incidence of acute emotional disturbances in seamen of the merchant marine who had been torpedoed. Some of these men had "startle" reactions, personality changes and symptoms of psychoneurosis and could not return to sea. It was found that the torpedoing of their ship bore no relation to the disturbance, and in general the most likely causal factors were considered to be endogenous and not exogenous.

Although attack by gas never appeared to be more than a possibility, it was known that the Japanese did possess chemical warfare weapons in some form, probably mustard or lewisite, and precautions had to be taken.

One medical officer, Surgeon Lieutenant T. A. McLean, received special training in the medical aspects of gas warfare, and visited various parts of Australia and New Guinea in order to advise on defensive precautions. A report received by the Naval Board of a tragic mustard gas casualty in Canada illustrated the necessity for adequate instruction being given on (*a*) the gases themselves, and (*b*) the procedure to be followed when an accident occurred. A lieutenant in the Canadian forces was demonstrating the use of gas training expedients to his platoon. He ignited a mustard gas bomb but it did not explode; 15 minutes later he approached and kicked it. It exploded and he was drenched from head to foot with liquid. He rinsed his eyes and applied ointment immediately, but did not remove his clothes until 10 or 15 minutes later. He was admitted to hospital, and despite all the efforts of the medical staff, died seven days later.

It was unlikely that any form of chemical warfare would be successful in an attack on ships at sea, but all men were supplied with and trained in the use of gas masks, and certain other items such as bleach anti-gas ointments were provided. On shore more elaborate precautions were necessary, and protective clothing was provided, as well as other necessary equipment and decontaminating centres.

Industrial types of poisoning were sometimes seen in the R.A.N. through contamination with a poisonous substance or vapour. Toxic symptoms could arise by contact with poisonous liquids such as benzol, with an associated affection of the blood cells. Tetryl dermatitis could also arise in susceptible persons from contact, and arsenical poisoning might also be due to the handling of castings. More familiar was the toxic effect produced by burning off lead paint in a confined space: this was occasionally responsible for symptoms of plumbism.

A more important and potent cause of poisoning by fumes was that due to nitrous gases, which could easily give rise to toxic signs when imperfect combustion of nitro-explosives such as cordite had taken place in partly enclosed areas of a ship. In confined spaces such explosions could produce a concentration of gases sufficient to cause not only toxic but lethal effects. Of the fumes arising in this way those of the nitrous type were found to be far more toxic and potentially lethal than carbon monoxide, which was produced at the same time.

In this type of respiratory poisoning there was a long, latent period between inhalation and the appearance of serious symptoms. In fact, grave damage could be inflicted before the real state of affairs was realised. Nitric and nitrous acids were formed on contact of the gases with moisture in the respiratory passages. These acids predominantly affected the bronchial tree, in particular the alveoli, and could bring about a progressive oedema of sufficient severity to cause death. The Naval Technical Instructions included an account of this condition. It laid special stress on the minor early symptoms in contradistinction to those arising after the deceptive latent period was over. These later manifestations were dangerous, and caused a characteristic clinical picture. This was one of grave

respiratory embarrassment with increasing dyspnoea, distressing though productive cough, accompanied by cyanosis, and wide, scattered, moist rales in the lungs.

Treatment was directed to relieve pulmonary oedema and congestion: to do so the administration of oxygen was necessary, using an effective method such as a B.L.B. mask. More important still were the measures based on prevention, all care being taken to limit the possibility of exposure of men to danger. At the time of possible exposure to nitrous fumes danger was always to be suspected, and the presence of an air or oxygen-breathing apparatus was found highly desirable: as a protection against fumes even a service respirator was of value. Further, all men exposed to the hazard of nitrous fumes were regarded as suffering from a serious degree of poisoning, and they were not allowed to be exposed to exertion for several days; no intravenous transfusions were permitted, and all possible means of reducing vascular congestion were taken.

When a ship was exposed to nitrous fumes the possibility of potential nitrous poisoning had always to be kept in mind until this risk had passed. Where bacterial infection supervened a drug of the sulphonamide group was administered, and atropine or adrenalin could be given with advantage. Morphine was also of value, particularly in allaying restlessness.

CHAPTER 12

INFECTIOUS DISEASES

INFECTIOUS diseases were sometimes a more serious problem in Service medicine than battle casualties, as evidenced by the loss of man-hours they produced. In ships at sea even small outbreaks might be significant because of the limited space available for isolation and the difficulty of replacing personnel, and it was fortunate that opportunities for infection by the most prevalent agents were more limited in the navy than in the other Services. Infections did occur, however. At the end of 1941 Surgeon Commander L. Lockwood listed a number which were treated in the fleet while *Hobart* was serving in the Mediterranean: amoebic dysentery, bacillary dysentery, catarrhal (infective) jaundice, cerebro-spinal meningitis, malaria, pulmonary tuberculosis, typhoid and paratyphoid fevers, undulant fever, diphtheria, pneumonia, erysipelas, rubella, scarlet fever, smallpox, poliomyelitis, mumps and measles. Of course, ships on the Mediterranean Station had to call at ports in the Middle East where there were health hazards quite apart from those normally expected to produce problems of recognition, prevention and treatment.

An analysis of infectious diseases in the R.A.N. to the middle of 1945 showed that while measles were not significant as an epidemic, mumps were widespread in some ships in 1939-40, though not serious in degree, and in the same year rubella affected training depots in large numbers, but not sea-going ships. Influenza had an evident effect upon sick wastage when local epidemics started, and the common cold was also a cause of short-term invalidity. Bronchitis occurred with moderate frequency in association with respiratory epidemics, but pneumonia was observed in only a relatively small number of cases. The actual numbers were not *per se* of significance as they dealt with populations of variable size and still more variable distribution over differing climates. When large numbers of men were carried in a transport the effect of propinquity was clearly apparent if an epidemic disease was introduced. In *Manoora*, which was conveying 1,100 army officers and men to Western Australia, there was an outbreak of measles accompanied by an epidemic of an influenzal type of cold, a combination which imposed a serious strain on the accommodation in the sick bay.

Closed communities such as ships and Arctic and Antarctic expeditions often found that they were immune from many of the respiratory epidemics unless some carrier from without intruded into their microcosm. In many ships and in large land-based establishments, which were closed and semi-closed communities, large epidemics of upper respiratory tract infection ("U.R.T.I.") could and did occur. The Australian destroyers in the Mediterranean suffered outbreaks of respiratory infections during the winters of 1939-40 and 1940-41 due in a large measure to the unsatisfac-

tory ventilation of the ships and to prolonged bouts of bad weather. The story was the same in the destroyers on other stations. While on escort duties with the Eastern Fleet in the second quarter of 1942 an influenza epidemic struck down 35 ratings in *Nizam* within a few days. The appearance of a rash on the trunk created a problem of diagnosis, but it was finally considered to be due to the fact that the patients had more or less to "stew in their own sweat". Nursing was done on the mess decks under difficult conditions until the ship reached Mombasa where it was discovered that there was no hospital accommodation ashore. *Nizam* was therefore quarantined and patients were nursed under the forecastle awnings. *Nepal,* also operating with the Eastern Fleet, suffered an epidemic of an influenzal type of common cold in the latter half of 1942. To call this an epidemic of common cold would not be strictly accurate, for it had many features not typical of this diagnosis, and the symptoms were not so severe that it could be labelled true influenza. The outbreak was associated with a prior outbreak of tonsillitis. Contributing causes were lowered resistance due to long periods at sea and a consequent unavoidable deterioration in diet, damp and confined living space, and rapid climatic changes varying from winter to tropical heat. An attempt was made to confine the outbreak to the two messes most affected by instructing their members to gargle with potassium permanganate solution 1/8,000 t.d.s. This was a failure: patients overflowed from the sick bay and had to be accommodated on stretchers aft. When port was reached they were sent to hospital, and the ship was quarantined.

At the end of 1943 there was a minor influenza epidemic in *Napier,* the infection apparently having been picked up in Bombay. The ship was proceeding to Mombasa and on arrival there was put in quarantine. Patients were isolated in the one mess, and the others had their throats sprayed daily with 1 per cent zinc sulphate. These measures were successful in arresting the outbreak.

The armed merchant cruiser, *Manoora,* serving in waters around Australia, suffered from epidemics of influenza and infective laryngitis in the last quarter of 1940. There were also many cases of common cold on board: they were treated with sulphathiozole, and although the condition was not completely arrested, there was no loss of man-hours. The cruiser *Adelaide,* also serving on the Australia Station, suffered an influenza epidemic at the end of 1941, after a period of 28 consecutive days at sea when the weather was so rough that even the upper deck scuttles could not be opened and only artificial ventilation was possible. The epidemic ran for 23 days, and at one time there were 56 men on the sick list.

The heads of the different medical services feared that a pandemic of influenza might break out during the war, and reports of epidemic respiratory disease in the Austral-Pacific zone were circulated from the Commonwealth Department of Health. Fortunately no such epidemic outbreak occurred, though it is possible that it appeared sporadically and unrecognised, as there were no facilities for isolating and identifying the types of influenza virus, except in large centres.

Meningococcal infections were not often seen but early recognition and treatment were important. An acute outbreak of an infection was observed at Darwin at the beginning of the war, of which a rash and neck stiffness were features, but though a suspicion of meningeal infection was aroused the infection proved to be dengue fever. Very occasional confusion also occurred in malarious areas when the possibility of cerebral malaria had to be considered. One patient suffering from pneumococcal meningitis was successfully treated with penicillin. Another type of meningococcal infection occurred which was relatively benign and more generalised in its incidence. This was the so-called "Benign Meningococcaemia", which might persist for months or even years with few symptoms beyond debility and a skin rash. Frequently the skin rash, which was often little more than a few scattered macules, went unnoticed, so that medical returns of "pyrexia of unknown origin", "influenza", and so on, might include instances of meningococcal infection. It is significant that at "Canonbury" Naval Hospital, with an average of 40 occupied beds, three instances of this type of infection should occur in four months at a time when there were no indications of a meningitis epidemic in the Service or among civilians ashore. These patients were all from separate small seagoing ships, in which men were very closely congregated. They had been ashore in a capital city every two to four weeks, so that no inference could be drawn as to the duration of the incubation period involved.

Though usually of sporadic distribution, epidemic manifestations of meningococcal infections sometimes appeared: spontaneous recoveries also occurred. Another curious feature seen in these infections was the occasional development of meningeal symptoms though none had appeared at earlier stages. A concise account of this infection was given in the Technical Instructions of the R.A.N. A rapid onset was observed like that of influenza but a diagnosis could be made by the continuous or intermittent fever with successive crops of a rosy macular rash with haemorrhagic centres and tenderness and effusion in the small joints. Pathological proof was obtained by culture from nasal swabs, blood culture, or complement deviation tests. Sulphonamides acted as a specific remedy, and even if spontaneous resolution had occurred, a course of sulphonamide was recommended lest the infection become localised in the meninges. Lumbar puncture was not advised except when severe symptoms were observed, but a course of 50 grammes of a sulphonamide drug produced rapid resolution and prevented recurrence or visceral complications. With the circulation to all medical officers of a complete clinical description of the infection and an indication of the use of a specific drug, diagnosis and treatment were simplified.

Glandular fever (infectious mononucleosis) occurred as an occasional epidemic manifestation in the R.A.N. In addition to the probable factor of propinquity in ships, there was a possible selective nature in glandular fever in the relative frequency of its attacks on young, healthy males. It occurred more frequently in a single R.A.N. hospital in one year than in

a large metropolitan hospital in 25 years, though its distribution in the civil community must have been considerably greater than this would imply.

Though not severe or common, it was brought specially to the notice of naval medical officers because of its capacity to mimic other diseases. A Technical Instruction on the subject was compiled and circulated to naval medical officers. The cases seen in the navy conformed roughly to the three predominant types described by H. L. Tidy—the febrile, the glandular and the anginose, appearing not infrequently in the guise of tonsillitis, with high temperature and occasional rigor. Ulcerative and anginose infections were not uncommon, apparently as a complication, and as Vincent's Angina was not infrequently seen in the navy, a suggestion was made in the official instruction that possibly not a few cases presenting the signs of Vincent's infection were really cases of glandular fever. The occurrence of adenitis affecting various groups of lymph glands tended to confuse the diagnosis. The groups were anterior and posterior cervical, axillary, inguinal and abdominal. The glands were noted to be firm and rubbery in texture, and were the site of discomfort and even pain. The appearance of abdominal glandular swellings sometimes suggested enteric infection, but large swollen inguinal glands pointed, on the other hand, to glandular fever. One of the features noted was the frequency of delay in the emergence of symptoms which later became characteristic. Thus glands might be slow in swelling, say several days or more, and the blood manifestations likewise did not always show till some weeks had passed. Earlier blood changes were found of great diagnostic help, in particular a high mononuclear count, 60 to 80 per cent of the white cells, coupled with neutropenia, and later agglutination of sheep red cells.

Skin eruptions were noted in scattered form, and attention was drawn to the possibility of confusion with syphilis, especially as a false positive response might be given to a Wassermann test. The skin rashes could also simulate one of the exanthems. Jaundice was seen sometimes towards the end of the first week but did not persist, the symptoms in this respect differing from those of infective hepatitis.

Meningeal involvement has been described, the cerebro-spinal fluid containing polymorphous cells but no organisms. One such case was reported in "Canonbury". The diagnosis offered no difficulty when investigation could be made: blood findings were mostly characteristic. The usual complete recovery was observed in all cases seen, though convalescence was often prolonged.

The confined living conditions in ships were conducive to the spread of poliomyelitis, as instanced by an outbreak in *Nizam* in May 1945. This ship was quarantined for nearly a month, and while only five out of sixteen suspects were proved to have acute poliomyelitis, four of these had palsies of probably permanent type. The pains and cramps in various muscles were a feature of this outbreak, and a certain degree of neck rigidity was also observed. In one instance it was possible that pain, apparently arising from a hydrocele under treatment with a sclerosing

agent, might have confused the early diagnosis. The first case occurred 14 days after the ship left Sydney where the disease was then active. It seems probable that the infection was contracted there, but the possibility of a carrier or a missed "abortive" case being present cannot be overlooked. The next case occurred 15 days later and the others apparently arose from this second focus or from a carrier. The next three cases occurred within the space of a few days, and it is reasonable to suppose that they were infected from a common source. Most of the patients were in the signals branch. Prophylactic measures were adopted for the remainder of the ship's company and the proven patients were transferred to the New Zealand hospital ship *Maunganui*. The chief preventive measure prescribed was the use of 1 in 20,000 potassium permanganate in normal saline to wash out the nose and gargle the throat.

Very little scrub typhus was seen since ships' companies were not exposed to the risk of the bites of infected mites, except in land installations and their neighbourhood. As it was recognised that there was no way of determining the risk of scrub typhus in any given area except by the occurrence of cases, precautions were taken by naval personnel on shore in places where there was potential risk of infection. These precautions included the wearing of appropriate clothing, the use of mite repellent, avoidance of unnecessary contacts with the ground or vegetation, the destruction of rats and the laying of pathways, especially of white sand, which had been found to repel mites.

Technical Instruction No. 17 dealt with scrub typhus and scrub itch. This gave a brief account of the vector larval mite and described it as being found in several locations such as decaying vegetable matter, in kunai patches, especially where these merge into the jungle, and in tall pit-pit grass in damp, open depressions. Measures of prevention were fully described, in particular the correct method of applying anti-mite fluid to clothing. Full information was also freely available from the army technical literature and instructions.

Murine typhus was of more importance in ships but except in certain areas it occurred only as an occasional manifestation of an endemic disease. In Australia it appeared chiefly in the vicinity of sea ports, and most frequently in those of Western Australia, particularly Fremantle.

The clinical problems of malaria were similar in all Services. The routines of hygiene, prevention, suppression and treatment were also similar and are fully covered in Volume I of this history.

The conditions laid down by the army governing the definition of malarious areas in and north of Australia were accepted in general terms by the navy. New Guinea and the associated islands, up to 170 degrees East Longitude and 20 degrees South Latitude, and temporarily the district of Cairns were declared malarious areas. Potentially malarious areas included that part of Australia lying north of a line drawn between Townsville and Broome, including the establishments in Townsville and Broome, Horn Island and Thursday Island and ancillary stations, and that part of the Atherton plateau lying above 2,000 feet elevation. If

urgent necessity dictated the transfer of an officer or rating to a potentially malarious area within six months of cessation of service in a malarious area, suppressive treatment was begun one week before transfer and continued on arrival in the potentially malarious area. The Naval Board was also informed of such impending transfers, so that notification could be made to the D.G.M.S. Army. Where appropriate, naval personnel had the notation "S.M.A." (served in malarious area) on their Service certificates and medical history sheets, and the information was also recorded in the drafting office. Those on transfer from a malarious to a non-malarious area were classified as Category "A", and the date of their transfer was noted. Men classified Category "M" (temporarily unfit for appointment or draft to a potentially malarious area) might be transferred to a ship carrying a medical officer, even if it was operating in malarious or potentially malarious areas, on conditions of periodic medical review, suppressive treatment for four weeks and therapeutic treatment for all relapses or primary infections. Category "M" lasted for six months. Complications sometimes arose in implementing these provisions. For example, in the Northern Territory ratings were often held at staging camps for unconscionable periods, which led to difficulties between the hygiene services of the army and naval medical officers. The reason was that instructions from the Naval Board concerning movements took an excessively long time to reach Darwin. Such delays seem inseparable from correspondence with distant headquarters.

A special notice was circulated by the British Ministry of Shipping acquainting ships' surgeons in the Merchant Navy with the treatment and disposal of seamen with malaria. A similar pamphlet was circulated among R.N. ships, and was also available to the Royal Australian Navy.

Regular reports to the Combined Advisory Committee on Tropical Medicine, Hygiene and Sanitation, at General Headquarters, S.W.P.A., were made by each of the Services in New Guinea and related areas showing the incidence of all tropical diseases. The rate per 1,000 in the R.A.N. for each four-weekly period was usually under 0.1. From this it will be seen that the proportion of officers and men exposed to the risk of malaria was low. In the larger land depots where adequate supervision was possible malaria presented little or no problem. Protective clothing was worn and suppressive atebrin was taken. In the forward areas the malarial rates were higher and the relative lack of anti-malarial training was apparent. The supervision of parties of ratings in signal and W.T. stations, for example, was difficult, and material for preventive use was often deficient. The naval units were small in these areas, and units of other Services—the Australian Army and Air Force and the United States Navy—gave assistance in malaria prevention.

Of the areas likely to prove a malarial risk to the navy, Milne Bay was one of the most highly infected. The heavy vegetation, which could only be cleared immediately round camp sites, the streams in which dense grasses grew, the high annual rainfall of 140 inches a year, the almost unvarying temperature averaging 85°F., with a humidity of 75 per cent,

and the many stagnant pools, all encouraged the breeding of the abundant anopheline *punctulatus*. In addition to the control exerted by the army, the navy exercised its own measures of control. The substitution of atebrin for quinine as a suppressive was a considerable improvement. Preventive measures included the spraying of small bodies of water with Malariol, and large areas with Paris green, the drainage of swamps, clearing of streams, filling in of wheel ruts, and transporting natives at sunset to accommodation 10 miles from the area. Plasmoquine was used as a gametocide in the final stages of treatment.

Most of the cases seen were of the malignant tertian type; occasional cerebral cases were encountered, and a few of blackwater fever. Near the naval establishment the natives showed a splenic index of 60 per cent, and 3.7 per cent carried gametocytes, though these figures were higher in other areas some distance away.

Surgeon Commander A. E. Rowlands, during a visit of inspection to New Guinea in October 1944, found that men of the R.A.N. destined originally for sea service showed little appreciation of the necessity for tropical hygiene and malarial control when placed ashore. This was evidenced by the higher incidence of tropical disease in areas where the R.A.N. was operating alone or where the malarial control and hygiene units of other Services had withdrawn. It is true that the army had shown the same reluctance to adopt tropical discipline until unit commanders were made to understand that they would be relieved of their command if their men became malarial casualties. Rowlands felt that faulty naval tropical discipline could be attributed to insufficient instruction in malaria control being given to officers proceeding to land-based establishments in the tropics. He recommended that a small percentage of officers destined for such establishments should be sent to the Tropical Hygiene School controlled by the army.

The advent of the R.A.N. Hygiene Unit in the New Guinea area led to a considerable improvement, though in October 1944 Surgeon Lieutenant T. A. McLean reported that in Madang the malarial rate was still high: natives were allowed to remain at night in the same camp as ratings, and clothing regulations were not strictly enforced, some officers setting a bad example in this respect. By December of the same year the rate had decreased as a result of the stricter enforcement of instructions. However, the regulations concerning clothing and the use of nets and atebrin continued to be ignored by some ships lying alongside, and cases occurred on board.

In *Yarra* numbers of cases of malaria, both of benign and malignant types, were recognised while that ship was lying off Basra on the Shatt-el-Arab in mid-1941. The reason for the infestation—50 cases in two months—was the presence of the ubiquitous mosquito, and the difficulty of taking efficient precautions while the ship was kept in the first and second degree of readiness by day and night. Lookouts, signalmen and machine-gun crews were all exposed to mosquitoes. It was notable that the incidence among stokers was much less than among seamen. The

repellent issued lost its potency after two hours. Prophylactic quinine was not found effective, and was discontinued in favour of atebrin. Mosquito nets were only available in small numbers.

Other tropical diseases flourished in many areas where there were naval shore establishments, and preventive measures were often hampered by the small number of men available for carrying them out. In Darwin time and energy were needed to overcome the inertia which had pervaded the peacetime campaign to control *Aedes aegypti,* the vector of dengue. Surgeon Lieutenant C. L. Statham of H.M.A.S. *Melville* reported in March 1941 that dengue had assumed epidemic proportions. Two distinct types were noted: one showed the typical remission on the third to fifth day; the other, less common, had a continued pyrexia, with more disturbing constitutional symptoms, such as abdominal pains and vomiting, followed by a longer period of weakness and depression. In several cases greatly increased reflexes, marked Kernig's Signs and a little neck stiffness were observed on the first day. None of these cases failed to produce the typical rash.

During the transitional period between the wet and dry seasons several pyrexial cases of unknown origin occurred. These bore a resemblance to dengue fever but lasted only three days. Some observers considered them to be attenuated dengue. Statham pointed out that the clinical picture of these cases bore some resemblance to the sandfly fever which occurred in Palestine. In March 1943 there was a higher rate of dengue in Darwin among naval men as compared with army. An army mosquito control unit had been active in the area for many months and while this unit gave every possible assistance in carrying out mosquito control in naval areas, dengue had been endemic there for years and the army unit was too small to obtain adequate results immediately. However, further help was forthcoming, and by December 1943 stringent hygiene measures had been successful in reducing the incidence of dengue, and the medical officer of the Darwin Naval Hospital, Surgeon Lieut-Commander C. P. C. Reilly, was able to report control of the vector.

In various areas dengue appeared in those so-called atypical mutations which are in fact characteristic of this type of virus infection. Surgeon Lieutenant L. V. Carter described an outbreak of pyrexia of unknown origin at Port Moresby which was apparently of this order. In addition to rapid febrile onset, post-orbital headache and muscular pains were common features, as were conjunctival and pharyngeal congestion and tenderness of the muscles. The course was longer than is usual in dengue fever, four to eight days, and the fever showed three decreasing peaks. In the absence of sandflies, there seemed little doubt that the disease was a variant of dengue, though few mosquitoes were found in the area. A suggestion was made that it might be of rickettsial origin but there was no evidence of this.

In H.M.A.S. *Magnetic* at Townsville Surgeon Lieutenant I. S. M. Murphy noted that during an epidemic of dengue fever two types of disease occurred, one with high temperature, and one without any fever.

He also noted that one attack did not always confer immunity. Relapses soon after the initial attack were not uncommon.

Variations in symptoms were also apparent in different epidemics. Hypersensitivity of the skin was a notable feature in 1944, so too was post-febrile depression, a feature specially prominent among members of the W.R.A.N.S. Like other observers Murphy thought of the possibility of some form of typhus or other rickettsial disease imitating dengue. The afebrile type of attack was of some interest. It might be that the relatively afebrile type of the dengue fever was similar to a mild fever which was locally noted, the general symptoms agreeing with those of dengue, including vesicles of the palate, but disappearing on the third day.

Tropical polyarthritis, described for the first time in the Northern Territory, was observed in Darwin three months after its recognition at Katherine. Cases were seen in the Darwin Naval Hospital during the first quarter of 1943. The symptoms were of rapid onset. Pains in the joints, associated with periarticular swelling and occasional effusions, chiefly affected the knees and ankles. Fever was slight and brief, lasting only about two days. Lymph glands were often enlarged and tender. There was a vesicular eruption on the palate. Though the fingers and toes presented a fusiform swelling like that of rheumatoid arthritis, the resemblance was only superficial and the condition usually disappeared in some three weeks with no sequels. Surgeon Lieutenant S. A. Sewell pointed out that seven out of eight patients seen with this disease had previously had dengue fever. He suggested that this might be a form of dengue modified by previous sensitisation.

Pulmonary tuberculosis was not unduly prevalent in the Australian Navy, and the introduction of radiological examination made for a still smaller incidence. One curious feature observed in 1939-40 was that out of 23 men affected 6 were cooks. The rates per 1,000 men were as follows from 1938 to the end of the war:

Year	Rate per 1,000 carried
1938	1.32
1939	0.21
1940	1.93
1941	2.07
1942	4.93
1943	1.52
1944	2.07
1945	2.09

Care was taken to avoid imposing a diagnosis of "pulmonary tuberculosis" solely on the result of one radiological examination. Instances were found in which the radiological report stated that tuberculous infiltration was present but subsequent investigation proved the condition to be non-tuberculous. A special instruction was circulated on this subject. In this it was pointed out that the medical officer had a serious responsibility to the patient and the Repatriation Commission as well as to the Service. Radiologists reporting on chest films were directed to qualify their

diagnosis with terms such as "probably" or "apparently" unless other facts established the diagnosis beyond reasonable doubt.

Though the introduction of miniature fluorography into the preliminary examination of all naval personnel was effective in excluding from the Service men suspected of a tuberculous lesion, now and then pulmonary tuberculosis would stealthily develop, as it might in any walk of life. In the Mediterranean in 1940 some discussion arose over a case of advanced pulmonary tuberculosis discovered in the ship's company of *Vampire* in the course of a routine medical inspection of ratings. Several other men were regarded as suspects on general grounds, but none was found to be affected. The commanding officer of *Vampire* reported that the discovery of a case of tuberculosis in their midst caused worry among the ship's company, especially in view of the poor ventilation and the discomfort caused by water entering the mess decks from head seas. Vice-Admiral J. C. Tovey, commanding the Light Forces, criticised this report, apparently on the grounds of morale, but surely it was natural for any men in like circumstances to feel some concern. There was no question that the ventilation of these ships was bad until the system was remodelled at refit, and that blacking-out made conditions very unpleasant. Dripping of water through cracks in the decks also increased discomfort, though of itself it would hardly be a significant factor in spreading tuberculosis. Among young adults such disease might arise from a pre-existing (endogenous) focus or from an external (exogenous) source, and, as is well known, the relative importance of these types has been the subject of debate in the past. The medical observer could only applaud a commander who, concerned for the comfort and welfare of his men, had sought to allay any uneasiness they might feel by the reassurance of a prompt and satisfactory examination.

Figures dealing with the incidence of venereal disease in the navy are apt to be misleading, as they varied with opportunities for infection. The fall in the figures in the later years of the war may not be attributable to improvements in prophylaxis. In 1939-40 the incidence was approximately 60 per 1,000, and by 1943 had fallen to 32, while in the next year it was 18. The incidence of syphilis was never high, but it too fell from 4 per 1,000 to 2 per 1,000.

The difficulties of treatment on board ship were considerable, though even in a smaller ship such as a destroyer it was practicable if the means for diagnosis were provided. A special mess was conducted for men infected while on leave, and no doubt provided in itself a certain deterrent. Surgeon Lieutenant S. A. C. Watson of *Nestor* thought it essential that treatment should be given on board so that the circumstances of cure should not be made more attractive than normal working conditions, as would happen if the patient were sent out of the ship for treatment. On the other hand, members of a ship's company disliked the presence of others who had an infectious disorder. Isolation presented problems, especially in small ships, and impinged further upon the already restricted space available for sanitary purposes. Preventive ablution centres were

hard to maintain, and not effective in practice when, as often happened, they were used far too late. An increased incidence of venereal disease usually followed leave, especially if there was a period of continuous leave after a long period of sea-going duty.

The introduction of sulphonamides in the treatment of gonorrhoea saved many man hours, but the problem of resistant strains gave trouble. Surgeon Commander J. M. Flattery in *Australia* treated gonorrhoea with a daily dosage of six tablets of M. & B. 693 for five days and four tablets for the following five days: urethral irrigations of oxycyanide of mercury 1 in 8,000 were carried out thrice daily. After completion of a course of chemotherapy the irrigations were carried out for a further seven days. Patients were usually discharged from the sick list in 24 days. When a resistant case appeared it was treated with success with sulphathiazole. Surgeon Commander W. E. Roberts in *Adelaide* employed the combination of absolute rest with sulphapyridine, continued in maintenance doses of 1 gramme after the first full course was completed. The men were isolated in hammocks outside the sick bay until all fear of relapse had passed. Some medical officers used local treatment as well; others had good results from oral therapy alone. Complications were less common with sulphonamides than with older methods.

Syphilis was more difficult to treat at sea. The risks of infection were not negligible, yet, as mentioned, isolation measures were difficult to apply. There was little venereal disease in the Australian destroyers in the Mediterranean in 1940, but the medical officer found that the isolation of even one sanitary fitting imposed inconvenience on those not affected. Occasional toxic effects were noted with combined bismuth and arsenic treatment, necessitating a decrease in the dose or the giving of N.A.B. alone. Where no medical officer was carried treatment by arsenic and bismuth was impracticable. On the whole, the introduction of modern methods made treatment in ships more feasible, and the period of contagion and therefore of risk was much reduced.

The general problem set by these infections still remained, whatever the Service. Surgeon Lieutenant H. B. Holmes in *Nizam* no doubt expressed the views and experience of many other medical officers of ships when he stated in 1943 that the incidence of venereal disease was still too high. The introduction of rapid and effective remedies had lessened the penalty incurred by the man who acquired an illness which was preventible and anti-social, and bred the attitude that infection was a matter of no great consequence. Warnings of the possible sequels, which were given to all ratings under treatment, were generally met with disbelief.

A pharmacist who objected on moral grounds to the Services making prophylactic facilities available to men who requested them created a controversy which in 1944 reached Ministerial level. The Standing Committee of the Service Medical Directors considered the whole question, and as a result it was clearly stated that the sole object in providing prophylactic facilities was to prevent venereal disease: that strict continence was advised by the medical officers of all Services, and prophylactic facilities were sup-

plied only to those who refused to accept this advice: experience had shown that by the adoption of these methods a definite degree of control was being maintained. But, as Surgeon Captain W. J. Carr remarked in a minute, the subject is an old and controversial one and is concerned with aberrations of social conduct the springs of which lie deep in human beings.

Bowel diseases were not a significant risk in ships at sea but when they did occur they presented a problem, as the facilities for dealing with them were limited. In the second quarter of 1941 Surgeon Lieutenant A. McL. Millar reported an epidemic form of "summer diarrhoea" in *Nizam,* which at the time was serving on the Mediterranean Station. Fruit, vegetables and the drinking water were variously named as the source of the infection, though the Medical Officer of Health in port gave an assurance that the water supplied to the ship was safe and need not be treated further on board. The disease varied from mild diarrhoea with colic and tenesmus, which responded rapidly to fluid diet and simple medicinal treatment, to a more severe colitis with fever and the passage of blood and mucus. Although the condition was prevalent on the Station there was no regular routine of treatment. Patients in *Nizam* were placed on a strict fluid diet and given pulv. kaolin co.

In ships transporting large numbers of troops bowel diseases were a more serious problem. *Perth* evacuating casualties from Greece and Crete had to isolate infectious cases of bacillary dysentery in the Petty Officers' recreation room, which was subsequently fumigated. Surgeon Lieutenant S. E. L. Stening of *Waterhen* reported that when men suffering from dysentery were carried on the Tobruk ferry service the sanitary accommodation was quite inadequate. Separate heads were allocated to these dysentery cases, but they used any and all, and even sentries were powerless to stop them.

Occasional outbreaks of a mild type were also encountered in naval personnel, but these infections yielded to the methods found effective in other Services, particularly sulphaguanidine. A diagnostic difficulty noted by Rose in army units (see Volume I in this series) was also described by Surgeon Lieutenant J. H. Begg. This was the problem of appendicitis occurring in conjunction with dysentery—a combination seen not infrequently in the campaigns in the Netherlands East Indies.

Stening noted that diarrhoea and dysentery were major problems with the naval personnel in every P.O.W. camp of which he was an inmate. His experience with undernourished men in these camps led him to believe that the toxic effect of sulphonamides was enhanced in men debilitated by starvation and disease. Sulphaguanidine in normal dosage often caused side effects, and 2 grammes per day or even 1 gramme was a sufficient dose if such effects were to be avoided. These drugs appeared to precipitate renal failure in debilitated men, and oedema would speedily appear and increase in degree. In severer infections where constant diarrhoea was frequent general oedema also occurred. Stening reported, however, that recovery took place even in men who were submitted to repeated tappings.

CHAPTER 13

DISEASES OF THE SKIN

SKIN affections were of frequent occurrence in tropical climates and at one time casualties in the Australian Army from this cause exceeded those from malaria. The skin diseases encountered in the navy were in general the same as those seen in the army, but differences in environment caused altered distribution of the common types. Surgeon Lieut-Commander C. G. Semler of H.M.A.S. *Platypus* recorded that "prickly heat" or *miliaria rubra* occurred most frequently and noted that it was often the precursor of other secondary dermatoses, particularly those of an inflammatory type. In order after that came the variants of impetigo, tinea, furuncles, and ulcers arising from insect bites or minor trauma.

Prickly heat, aptly named because of the curious prickling sensation it caused in the affected parts, was troublesome by reason of its almost general distribution and its sequel of sweat rashes.

Experiments carried out by the Royal Naval Personnel Research Committee yielded some information on the disease. For a certain time each day over a long period subjects, wearing plimsolls and freshly laundered shorts or overalls or nothing at all, entered climatic chambers where they were subjected to a high temperature. On each occasion they were given two freshly laundered towels, one for use during the experiment and one for use after the hot and cold showers with which it was concluded. Their plimsolls were rinsed in fresh water and placed in a drying cupboard each night, and the climatic chambers and bathrooms were scrubbed out with disinfectant once a week. Only 4 per cent of the subjects showed any evidence of prickly heat, and even then the diagnosis was somewhat doubtful. The rarity of this condition during the experiments indicated that repeated exposure to very warm conditions for a few hours each day for as long as five months will not cause the condition, provided those exposed can spend some of the time between exposures in an atmosphere where their skin is not moistened with perspiration.

There has been considerable argument about the intake of common salt in prickly heat as a vehicle for the sodium ion. There seems to be a general opinion that an adequate intake of salt has a beneficial effect. Those factors which favour excessive sweating, such as covering the skin with clothing, and undue heat and humidity, as under blackout conditions, are just those which cause excessive loss of sodium chloride in sweat. Therefore a diminution of salt in the daily ration would not be expected to relieve *miliaria rubra.* A. A. Bartholomew[1] from personal experience believed that salt had not only prophylactic but therapeutic value in prickly heat.

Numbers of Australian medical officers recorded their experiences and conclusions. The possibility of a deficiency of riboflavin was raised by

[1] *British Medical Journal,* 12 Apr 1952.

Surgeon Lieutenant C. L. Statham at H.M.A.S. *Melville,* where some debilitated men showed oral lesions indicative of this deficiency during the hot, humid weather. All had been on the station for over a year. Surgeon Lieut-Commander Semler noted that in men wearing a working rig of only shorts and sandals prickly heat was confined to the "pants" area; given a cool change, even if for only a short time, their condition improved appreciably. Surgeon Lieut-Commander E. L. Susman and Surgeon Lieutenant F. R. Fay made a study of the condition, taking into consideration various possible aetiological factors, such as clothing, latitude of the ship, diet, age, weight, complexion, exposure to the sun, psychological aspects, occupation, types of sweat reaction and salt intake. The most extensive work was carried out by J. P. E. O'Brien and S. D. Allen, who studied in the army in the Northern Territory the relations of *miliaria rubra* to other anhidrotic states and dermatoses. This work is described in Volume I of this series. In the Royal Australian Navy supervening dermatological complications were not a common feature but *miliaria rubra* was none the less troublesome.

In assessing the results of investigations control of all factors is obviously necessary. Fay and Susman doubted if any absolute prophylaxis were possible. This might be true. However, it seemed that high temperatures, profuse sweating, and clothing which prevented exposure of the skin to the sun, were important causal factors; and that a sufficient intake of salt and the wearing of a minimum of clothing were useful prophylactic measures, indicating that rather more than a "healthy stoicism" could be achieved.

Surgeon Lieutenant A. O. Parker observed men in H.M.A.S. *Lachlan* with the so-called "sweat rashes" following prickly heat. He treated this series of patients, usually with success, by exposure to sunlight and the use of an antiseptic spirit lotion, but sometimes the use of one of the acridine dyes was called for. A number of cases with either a history or the symptoms of chloride imbalance were given salt tablets. Figures suggested that most of the cases carried out their duties in hot, sunless areas between decks. A small group of cases in *Lachlan* showed a lesion of the nature of a cellulitis, slowly spreading to form a hard indurated area which did not form pus. Sulphonamides produced only a temporary improvement but penicillin cured the lesion rapidly. Similar conditions have been described in other tropical zones.

Pemphigus contagiosus was occasionally seen as a probable sequel to *miliaria rubra.* No set bacteriological studies could be made in the R.A.N., but it was believed that the indolent lesions were usually streptococcal in origin. Auto-haemotherapy was sometimes used in addition to local treatment: the results were indefinite.

The number of cases of scabies occurring in the navy was not high. During the winter of 1941 fourteen cases were recognised in *Stuart* while that ship was on the Mediterranean Station. Sulphur treatment was not satisfactory, but the condition responded to benzyl benzoate. In *Vendetta* Surgeon Lieutenant J. F. Rutter also found that benzyl benzoate was

more effective and comfortable than sulphur ointment, ointments in any case being unsuitable in the tropics as they tended to spread infection. Disinfection of fomites, at first thought necessary in *Vendetta,* was abandoned without further spread of infection. In these and in later outbreaks in *Doomba* and *Hobart* the problem arose of providing space for isolation, always a difficult one, as it involved a disturbance of the normal working of the ship.

Other parasitic infestations were troublesome at various times. In *Platypus* Semler reported that cases of *tinea cruris* and *circinata* were common though readily controlled. The eczemoid type proved more obstinate, especially when it affected the toes. Copper sulphate electrolysis therapy was used with some success, but the cure was only temporary. In *Manoora* prophylaxis was encouraged by the use of foot baths of mercury bichloride and by a regulation compelling the wearing of shoes. As compared with other preparations, gentian violet dye 2 per cent was found most valuable in treatment. At H.M.A.S. *Melville* one case of *tinea circinata* was treated successfully with 1 per cent Brilliant green aqueous solution. Two men with resistant conditions were persuaded to abstain from bathing for a few days and to anoint their bodies with olive oil instead. Cures resulted in both cases.

Tropical ulcers—"desert sores" to the troops in Libya and Cyrenaica—were seen frequently in the navy, caused by a combination of trauma and infection of skin already macerated by sweat. An occlusive dressing, particularly as a first-aid method, was often successful. Numbers of naval medical officers held that a diet deficient in vitamins, particularly vitamin *C,* predisposed to this condition, basing their belief largely on the local and general improvement seen in patients when sufficient fresh food was added to their diet. It will be realised that trauma as a factor has a wide connotation, including not only injury by violence to the skin surface, but also by bites of insects. Many of these ulcers showed as a characteristic feature an indolent centre, reluctant to heal, and surrounded by satellite vesicles which became pustular. Such lesions could spread rapidly. Surgeon Lieut-Commander S. A. Sewell noted frequent cases of tropical ulcer at the Darwin Naval Hospital, the appearance of which corresponded closely to that seen in dermal leishmaniasis. As the disease occurred mainly among ratings working around the waterfront the possibility was considered of dermal leishmaniasis, spread by sandflies, being present in the Darwin area. In the treatment of these ulcers skin grafting was frequently necessary. The condition appeared to be identical with that usually referred to in Northern Australia as Barcoo Rot. In Sewell's experience vitamin therapy had no effect on the course of the disease, which led him to believe that its cause did not lie in a vitamin deficiency. At H.M.A.S. *Melville* Surgeon Lieutenant Statham noted an alarming increase in the number of epidermophytic lesions when the grass, which was from 6 to 8 feet high, was drying after the rains. Despite preventive measures infections continued to occur, the most extensive among members of the work-

ing parties clearing away the grass. Various lotions were used, each with varying success from case to case.

On the whole, local factors were not usually found important in skin affections arising on board ship, but a sick-berth attendant in H.M.A.S. *Benalla* noted that ulcers were common on the lower part of the legs of as many as 80 per cent of the ratings who had been in contact with coral and sea-water. The resultant ulcers commonly recurred and early treatment was important.

As mentioned in a previous chapter, Surgeon Lieutenant W. J. McLaren-Robinson of *Yarra* reported that while the ship was lying in the Shatt-el-Arab there was a lowered resistance to disease in personnel due to the heat, the limited diet, lack of leave and malaria. One result of this was a high incidence of infected bites and scratches. These lesions were very resistant to treatment and tended to develop into ulcers of an indolent type. They were treated with hot hypertonic saline baths and foments, eusol, magnesium sulphate with glycerine, acriflavine in aqua and spirit, and with occlusive dressings.

Closely allied to tropical ulcers were other forms of pyodermia such as furuncles and impetiginous eruptions. Though no set observations were made in the R.A.N., it was likely that these latter were commonly staphylococcal in origin and the indolent ulcers streptococcal. Acne often became pustular in the tropics, and Surgeon Lieutenant Semler noted that tropical conditions appeared to have definite effects in producing a recurrence of subsided cases of acne. These cases were very resistant to treatment and abscesses requiring incision were common. Various treatments were used for pyodermia, including the local application of sulphanilamide and mild antiseptic lotions and the internal administration of sulphapyridine. Experience later proved that the local use of sulphonamides had its risks owing to sensitisation. Elastoplast or similar occlusive dressing was useful, particularly in the mild cases seen in aid posts. Such treatment was best supplemented by adequate diet with added ascorbic acid if the diet was deficient in vitamin *C*. Auto-haemotherapy was also used occasionally.

Chrome dermatitis, so called, gave rise to no appreciable trouble in the navy. Most of the khaki clothing material likely to come into contact with the skin was vat dyed and did not produce sensitisation. Moreover, there was the possibility of other allergic mechanisms as well as the suggested action of trivalent salts of chromium on the skin. Some garments such as flannel shirts were obtained by the navy through army channels. The naval men did not like these garments, especially when worn in direct contact with the skin, but no trouble arose from them. Khaki socks were not made from chrome-dyed wool, so that whatever the method of production of this controversial form of dermatosis, chromium salts apparently played no significant aetiological role in the skin diseases seen in the R.A.N.

Generally speaking, the friction of clothing and the soddenness of macerated skin were among the most important causal factors of skin disease. Where circumstances permitted free access of sunlight to the

body the benefit was immediately apparent. Surgeon Lieutenant A. H. Robertson of *Arunta,* with the approval of the executive department, encouraged men on duty in warm climates to wear sandals and only the minimum of clothing, and as a result the frequency of mycotic and other infective lesions in the ship was noticeably reduced.

The necessity for wearing anti-flash gear in operational areas was, of course, an aggravation to skin conditions commonly encountered in the tropics. Surgeon Lieutenant J. H. Begg in *Warramunga* found that 20 per cent of the ship's company wearing this type of protective clothing at action stations had prickly heat. In relation to the necessity of preventing or limiting the lesions caused by burns, however, this consideration was unimportant.

Lack of proper laundry facilities was also a factor. In the New Guinea area there were laundry units for the Australian Army and the American forces but not for the Australian Navy. The laundry units of the other Services naturally moved with their own personnel and could not offer assistance. Surgeon Commander A. E. Rowlands commented on this in October 1944 after a visit of inspection to the New Guinea area. He believed that a laundry established where large bodies of the R.A.N. were congregated would lead to a heightening of morale, mitigate against the discomfort of the tropics where in the high humidity clothes were never completely dry, and finally help to prevent skin diseases.

Reference has already been made to the suggestion that dietetic deficiencies, particularly a deficiency of Vitamin *C,* were of aetiological importance. While no convincing evidence of this was obtained, the belief was helpful in securing a good mixed diet for naval personnel whenever it was available. General improvement in health often carried with it some degree of resolution of skin lesions.

It had been found in the British Eastern and Pacific Fleets that about 10 per cent of ships' companies and 6 per cent of those on shore were treated every month for some form of skin disease. Early in 1944 when it seemed that the defeat of Japan could be accomplished only by a series of amphibious and air operations which would keep a big fleet in tropical waters for many months, or even years, the Board of Admiralty invited the Medical Research Council's Royal Naval Personnel Research Committee to examine the effects on ships' companies of tropical climatic conditions. The experiments already described showed that clean bodies and clothes, and clean and well-equipped bathrooms, routine inspections, and frequent and early treatment where necessary would do much to reduce the wastage of man hours in areas where skin disease was rife. F. P. Ellis,[2] however, considered that these measures were inadequate and that ships which would be operating for long periods in the tropics should be specially built for the purpose. The truth of this was illustrated by the dramatic reduction in skin diseases and other heat illnesses when air conditioning was installed during the war in submarines operating in the tropics and more recently in frigates patrolling the Persian Gulf.

[2] *British Medical Journal,* 4 Sep 1954.

As might be expected, skin diseases were prevalent among naval men in Japanese prisoner-of-war camps. The conditions in some of these camps, described by S. E. L. Stening, were conducive to the spread of such affections. At Fukuoka, in Japan, there was a shortage of soap and hot water, and the men had no changes of clothing. Medical supplies with which to treat the affections were scanty: they consisted of potassium permanganate and copper sulphate, the latter being stolen from the near-by shipyard and brought in when required. It was at Fukuoka that an advanced case of leprosy was found among the Dutch prisoners. Infections of the skin were also common at Oeyama. When these were treated with sulpha drugs poisoning sometimes resulted. At Taisho the skin condition of the prisoners deteriorated with the onset of the cold weather and, when the Japanese placed limitations on the use of the bathroom, furuncles and carbuncles became very common. At Takefu the prisoners worked in the near-by carbide factory. At first they were given a 10 minutes' spell in the open air when they began to sweat. Later they were pushed harder and the spell was discontinued. They suffered from abscesses and acute irritative dermatitis caused by sweat combined with carbide, lime, fertilizer and other chemicals burning into the skin.

CHAPTER 14

AFFECTIONS OF THE EAR, NOSE AND THROAT

EAR, nose and throat complaints were responsible for considerable wastage of man hours in the navy.

Otitis externa was a common condition, especially in the tropics where a variety of names was applied to it, particularly "tropical ear" and "Singapore ear". It was significant that as ships entered tropical zones, so the incidence of *otitis externa* rose. A special Technical Instruction was issued by the D.N.M.S. describing the condition and its treatment. The belief that the cause was a fungus was fairly widely held, but this could not be supported unless microscopic examination disclosed a *trichophyton* or other fungus.

Bathing and diving, particularly the latter, were of definite causal importance. For example, H.M.A.S. *Hawkesbury* had many cases of *otitis externa* during a week when the ship was cleaning boilers and the men had free opportunity for bathing. The lesion was desquamative in nature, and its appearance distinctive, with a red epidermis and white raised patches which were oedematous in later stages. Debris tended to obstruct the canal and pain was often severe. Treatment varied considerably with the views of different medical officers, but the method recommended by E.N.T. specialists attached to the Eastern Fleet was easily applied in all sick bays. Debris was removed by gentle cleansing and syringing. Argyrol 10 per cent was instilled into the canal, and analgesics were usually needed to relieve the pain. In less than a week the flakes of epithelium could be removed and spirit drops used twice daily to complete desquamation and control infection. Other methods involved the use of packing, which was painful and therefore not usually recommended.

The standard treatment in H.M.A.S. *Whang Pu* at the end of 1944 was as follows. Having established that the ear drum had not been perforated, the medical officer gently irrigated the ear. Daily irrigations were given and meths b.d. In the majority of cases cure followed without the need for messy ointments or powders. Severe pain could be relieved by packing with glycerine ribbon gauze, provided the drum was not perforated. The packing was painful and needed to be firm, but an anaesthetic was not considered necessary. These cases were kept under supervision in case a mastoid developed.

Blast injuries of the ear have been dealt with elsewhere in a general way. These were particularly interesting to aural surgeons, but even more so to naval medical officers and medical officers of artillery regiments, who stressed the importance of preventive measures.

The subject was discussed at a meeting held in Sydney just before the end of the war at which experienced medical officers of the three Services were present. Various categories were discussed: (i) those causing middle-ear deafness with or without rupture of the ear drum, (ii) those

causing an abrupt high-tone loss, and (iii) those of slow onset with gradual high-tone loss due to slight concussions over a long period.

It was pointed out that blast injuries of the ear always caused bleeding but that this was not seen on mere inspection of the meatal opening. When a tear in the drum was seen there was often some eversion caused by the suction phase of the blast wave. Recovery in hearing usually took place after a variable period of weeks unless infection supervened. It not infrequently happened that pre-existing deafness increased after exposure to blast concussion. It was important to record hyperaemia of the drum as well as actual bleeding, as this might be present without any perforation. The loss of high tone in hearing was of cochlear origin and might occur quite gradually. Hearing had a much better chance of full restoration if infection was avoided; consequently it was agreed that the ear should not be syringed if there was any chance of damage to the drum. Further, although the instillation of sulphonamide powder was widely recommended, the safer treatment was held to be the insertion of wool packing. The opinion expressed at this meeting was that it was dangerous to blow anything into the ear after rupture of the drum, not only because of the risk of infection but also because of the danger of local sensitisation setting up *otitis externa.*

Prevention of injuries to the ear by blast depended on the use of protective devices inserted in the ear canal. Australian Army gun crews generally used simple plugs of improvised sponge rubber, cotton wool, or cotton waste, or the Malloch Armstrong Ear Defender, all of which gave some protection but were not completely efficient. Major G. C. Halliday stated in a discussion of the subject that he had examined all the artillery regiments of the 9th Division A.I.F. and had found only 3 per cent of perforations of the drum, though 80 per cent had some degree of deafness which persisted after the lapse of a year. This type of deafness was much commoner among units not using any protection.

In ships, wool plugs and special rubber plugs were used, and there was good evidence of the protection they could afford. It was also noted that ratings working between decks frequently became lax and did not use such protection, with the result that if they were exposed to blast they not infrequently sustained damage to their ear drums.

Experimental observations were made on the aural effects of blast by Mr N. E. Murray and Captain G. Reid in the Acoustic Research Laboratory at the University of Sydney.[1] They measured the extent of and recovery from temporary deafness in gun crews, and the effects of blast in volunteers subjected to the detonation of blank charges. Observations were made also on recorded low-pressure waves, so as to elucidate the connection of blast waves with deafness. As a result of a survey of artillery regiments, suggestions were made for protection and prevention of permanent deafness. They found that properly inserted cotton wool plugs gave reasonable protection from deafness to men who were not particularly

[1] N. E. Murray and G. Reid, "Temporary Deafness due to Gunfire", *Journal of Laryngology and Otology,* Vol 61 (1946), p. 92.

sensitive to the effects of noise, or when the degree of pressure was not very high. They did not protect subjects exposed to pressures of the order of 4.7 pounds per square inch. For pressures higher than this, protection was essential to prevent hearing loss and ruptured ear drums; for pressures of 1½ to 4 pounds per square inch protection was also necessary to prevent hearing loss; below this level the need for protection varied with circumstances and individuals. An ear plug designed by the Acoustic Research Laboratory and known to the army as Protector Eardrum Aust Mark I, gave complete protection for blast pressures of 4.7 pounds.

Naso-pharyngeal infections were most common in the navy during rough weather when a ship was battened down and ventilation was poor. A spray of 1 per cent zinc sulphate was tried in at least one epidemic as a prophylactic, but it was hard to say whether it had any specific effect. In these outbreaks the influence of confined living space was often evident: for example, in an epidemic in *Nepal* 10 out of the first 14 cases occurred in one mess, though after a quiescent phase in harbour the disease spread throughout the ship, illustrating the difficulty of confining an epidemic respiratory disease to one place. There was an outbreak of pharyngitis in *Nizam* at the beginning of 1941. At one stage the infection gained such a hold that it threatened to impair the efficiency of the ship. A number of R.N. ratings were borne at the time, and as these were not seriously affected, it seemed that the R.A.N. ratings, who had recently arrived from service in the tropics and had not experienced a severe winter for several years, were coming in contact with an organism the particular strain of which they had not encountered previously. It is interesting to note that the early cases were not nearly so severe as the later, and postulating a short incubation period for the infection, it is reasonable to suppose that the organism was attenuated but gained virulence by successive passage through a host whose resistance to it was poor.

Tonsillitis was a frequent source of illness in the destroyer flotilla in the Mediterranean during the first year of the war, and on the Australia Station Surgeon Lieut-Commander K. E. F. D. Hudson of *Adelaide* reported a total of 15 cases during the winter quarter of 1942, representing a manpower wastage of 70 days. Severe cases involved swelling and ulceration. Sulphanilamide gave good results.

Vincent's angina was sometimes a troublesome infection in ships, being no doubt favoured by propinquity. During a mild outbreak in *Adelaide* the eating utensils of the patients were kept separate, but the medical officers thought it was spread by droplet infection. Local treatment was recognised as important, and was carried out as far as possible under the directions of a dental officer. Packing with small plugs impregnated with an arsenical solution usually proved effective, and was preferable to injections of an arsenical preparation.

CHAPTER 15

DISORDERS OF THE EYE

THERE were no disorders of the eye that were strictly peculiar to the armed Services, or to any single Service, but the conditions of work called for in a mobilised force, particularly under action conditions, made them more prominent. Disorders of the eye from the Service point of view could be divided into: affections of function that might have a structural or a metabolic basis; infections; disturbance or loss of visual capacity or acuity due to nutritional defects; and trauma caused by radiation. Certain of these conditions were of special importance in naval officers and ratings whose duties exposed their eyes to more than average hazards.

Adequate night vision was necessary in all members of a ship's complement who were engaged in duties requiring the keeping of a lookout. The extent of dark adaptation varies in different persons, apart from considerations of age, which, by reason of its influence on circulation, lowers the capacity of the eye to restore its rhodopsin after exposure to bright light. Complaints of difficulty in seeing in a darkened environment were not uncommon in all the armed Services, and special methods were necessary to disclose the objective state of the eyes of these men, apart from psychological factors. Surgeon Lieut-Commander J. A. F. Flynn, the ophthalmic consultant to the Royal Australian Navy, published a description of a simple adaptometer which enabled an accurate test to be made of the power of seeing in poor light, and of adapting the vision for this purpose.[1] This apparatus consisted of a box containing a light, the intensity of which could be varied by apertures of 16 different sizes. At one end was a frosted glass screen, outside which was attached a movable shape which cast a silhouette on any desired part of the periphery of the screen. This was observed by the subject at a distance of six feet. As the intensity of the light decreased, the silhouette became more difficult to see. When accuracy in observing the silhouette fell to one half of the total number of attempts, the aperture was read on a scale and the results so obtained were classified as average, good, bad, or better or worse than average. Care was taken to secure uniform illumination, and control subjects were used for tests before other readings were taken. Tests were carried out in a darkened room after an adaptation period of half an hour. As would be expected, the silhouette was most easily distinguished by using the part of the visual field slightly off the centre.

A test of 332 members of the company of an Australian cruiser showed that the average and better-than-average degrees of adaptation made up 242 of the total. Flynn thought that such a test could be advantageously used to gain more experience of the factors influencing dark adaptation,

[1] J. A. F. Flynn, "Night Vision", *Transactions of the Ophthalmological Society of Australia* (BMA), Vol 3 (1941).

and that it should be of practical value in making a comparative classification of men carrying out duties which required good vision. He stressed that the tests were comparative only and could not be considered as absolute values; they were designed simply to provide a useful working basis for ships' commanders. No observations could be made at the time of the possible influence of various factors such as fatigue, nervous strain, and a deficiency of vitamin *A*.

A somewhat less elaborate test was made by Major C. S. Colvin to ascertain the frequency of defective dark adaptation among repatriated prisoners of war previously held by the Japanese. Of the 62 men carefully examined, 13 showed deficiency in dark adaptation ranging from 10 to 60 per cent of the average. It would probably be impossible to obtain reliable figures, as the ocular picture among captives of the Japanese was further complicated by the presence of nutritional amblyopia. Members of all Services in captivity in the eastern zones complained in many instances of poor night vision at some stage of their experience, but most of them recovered their adaptation at a later date when they had regained reasonable health.

Solar radiation was the most important type of radiant energy likely to affect the eyes, at least during the 1939-45 War period. Since the sun is so abundant a source of energy it may affect the eyes by short-wave, that is ultra-violet radiation, or by infra-red and visible radiations of a relatively longer wave-length.

Solar photophthalmia may be seen when ultra-violet rays affect the anterior structures of the eye; owing to the limited penetration of these rays the deeper structures are unharmed. This type of radiation trauma was not very significant in the navy; a certain degree of conjunctival inflammation was seen in susceptible men exposed to glare, but extraneous factors such as were in evidence in the Western Desert and similar terrain were absent at sea. For example, the conjunctival irritation common among transport drivers in Central Australia, with attendant scleral congestion and blepharospasm,[2] and the similar state observed in men at a ski school in Syria, were aggravated by atmospheric drying.

It may be noted that prolonged or constant exposure may cause chronic conjunctivitis in those whose skin structures are not resistant to this kind of radiant energy. Burn and blast injuries to the conjunctiva were greatly relieved by ol ricini, which was instilled either by such a device as the Bellamy Gardiner dropper or by a cork with a stem applicator.

Trauma caused by the more penetrant radiations was much more serious because of the effect of heat from the sun, which was concentrated by the refracting media of the eye on the retina. In a lecture in August 1942 Flynn drew attention to the serious nature of the lesions of photoretinitis sometimes found in anti-aircraft lookouts. This form of damage

[2] J. M. Dwyer, "Solar Photophthalmia", *Medical Journal of Australia*, 26 Apr 1947.

to the eye was important in civil life also, and could follow exposure to the blaze of the sun's light during an eclipse, or of an intense electric flash. In navy and air force practice photoretinitis was observed, and as the end results of the retinal damage might not always be ascribed to its true cause, recognition was important. Diagnosis was made more difficult because of the absorption of the short-wave radiations by the cornea and lens; the essential lesion was a burn of the retina. Flynn described several cases in a published article.[3] One of the patients was not referred for opinion until six months after the exposure of his eyes, when the nature of the lesion might not have been identified without an accurate history.

Most instructive was the case of two men each of whom had a solar injury of the eyes, and who noticed blurring of sight immediately owing to burning of an area of the macula. They were two anti-aircraft spotters, who while serving in the Solomons had been given the sun sector to watch. They had arranged between themselves to look out for 10 minutes alternately. At first they found it difficult to look at the sun because the glass in their protective screen was not nearly dense enough, but after the first 10 minutes a big dark disc with a narrow bright ring around it, appeared on the face of the sun and made it easy to watch. When they looked at other objects the black patch was still there, and covered the middle part of the picture. They continued to do this job for two hours. They did not have any pain. When examined later one of the men said: "The black blob still hides things, and when studied on the horizon, the blob appears like a burning match when dropped on shining brass or copper—a sort of blue colour running into yellow, and then a purplish black in the centre." Both men were found to have a central positive scotoma in each eye, and similar, clearly-defined round red areas with tiny spots of pigment in them. Both cases were diagnosed as photoretinitis and were kept under observation; they were given dark goggles to wear and were excused all upper-deck duties.

Another case quoted by Flynn was that of a rating who reported a blur in the middle of the sight of his right eye after he had been acting as anti-aircraft lookout during a battle when aircraft had been approaching his ship down the line of the bright tropical sun. He stated that he thought he had used his green smoked-glass screen properly. Examination with an opththalmoscope revealed on the macula a white area surrounded by a pigmented circle. A week later the vision was still the same; the white area on the macula had become very red. Twelve days later there was no change in his vision and the area on the macula had become pigmented and black. When he was examined eight months later his vision was the same but now he was also suffering from metamorphopsia. The lesion on the macula had developed into a pigmented scar.

The ineffectiveness of the glass screen used by these men on lookout work was obvious from their history. Flynn pointed out the necessity for

[3] J. A. F. Flynn, "Photoretinitis in Anti-aircraft Look-outs", *Medical Journal of Australia*, 31 Oct 1942, p. 400.

standardisation of protective goggles, screens and binoculars, to ensure that the dangerous parts of the spectrum were excluded. With J. C. Eccles he carried out some important investigations on the eyes of rabbits experimentally exposed to a midsummer sun through an appropriate aperture.[4] The solar energy, amounting to 1.49 calories per square centimetre per minute, had the visible rays for its larger component, but was reduced by absorption in the anterior part of the eye, and was further reduced at the retinal surface by the size of the pupil. Lesions were produced by exposure as short as 10 seconds; the most severe ones destroyed the whole depth of the retina and most of the choroid. Experiments were also made with protective filters. By comparison, the human eye would suffer a lesion from an intensity of radiation of 100 calories per square centimetre applied over a few seconds.

The importance of these considerations lay in the particular type of work done by aircraft lookouts, which necessitated looking directly into the sun in order to detect enemy aircraft attacking "out of the sun". A momentary glance of even unprotected eyes will do no harm, but a direct gaze can produce irremediable damage. The only type of glass that would prevent such a lesion was one that conformed to high standards, and exact standardisation was therefore needed to ensure that the protection offered was complete. Welders' goggles conforming with British Standards Specification 679 (1936) were suitable, and prevented troublesome afterimages. Investigation of the sunglass screen used by lookouts was called for if a lesion was suspected or discovered. It was recommended that warning of the risks entailed should be given to men engaged in lookout work, and to those who did not realise the danger of looking direct at a highly luminous source of radiation such as the sun's disc in an eclipse or the point of blaze in welding. Recognition of the condition was important, as the sufferer was entitled to a war pension.

Finally, it should be pointed out that it was not only severe burns of the retina that caused loss of central vision. Cases were encountered in the Royal Australian Navy in which anti-aircraft watchers were found to have blurring of vision, especially in the central area, but without a visible retinal scar. Surgeon Commander L. Lockwood, R.A.N., and Surgeon Lieut-Commander Flynn have described illustrative cases. One rating had a history extending back four years, to when he was an anti-aircraft lookout in the Mediterranean. Therefore when focal interference with vision was demonstrable, the history needed to be carefully explored as the absence of a visible retinal scar did not preclude the possibility of photoretinitis.

Visual acuity could be roughly tested under Service conditions. One eye was tested at a time; a "pin-hole" test with a stenopaeic disc was used as an approximate test of acuteness of vision, as any refractive error was largely eliminated and thus excluded as a cause of poor sight. The

[4] J. C. Eccles and J. A. F. Flynn, "Experimental photoretinitis", *Medical Journal of Australia*, 15 Apr 1944, p. 339.

application of a simple "cover" test was also used to detect a loss of binocular fixation, simply by covering one eye by an opaque screen. Minor degrees of fixation loss were disregarded.

CHAPTER 16

PSYCHIATRY IN THE R.A.N.

AT the end of 1943 a report was received in Australia on the work of a United Kingdom Committee of Psychologists and Psychiatrists in the Services, which considered selection problems in the Royal Navy and offered expert advice on the use of an approved battery of psychological tests. The battery included a variety of verbal and non-verbal intelligence tests, as well as specific tests to disclose special aptitudes.

While psychological tests were used as an aid to officer selection in the Australian Army in the later periods of the war, an official communication from the Navy Board to the Prime Minister's Department following the report on the U.K. committee disclosed that no special psychological tests were carried out before recruitment into the R.A.N. In view of the comparatively small numbers in the Service and the fairly wide field of choice open to entrants, the need for them seemed doubtful. However, while selection had not been reduced to a system, the volunteer nature of the Service and the acceptance of recruits for particular branches tended to lessen the possibility of men finding themselves in categories to which they were unsuited.

In view of the great distances covered by ships on service it was not practicable to employ purely naval psychiatrists, and only one R.A.N. medical officer was a psychiatrist. When questions arose concerning the treatment or retention in the Service of men with mental affections decisions were made by the Boards of Survey in the light of expert psychiatric recommendation, which was usually supplied by civil or army psychiatrists. Later, as army organisations in the field expanded, added facilities also became available to the navy.

After entry, men employed in ships at sea, and to a less extent those in some shore establishments, lived in an almost closed community, which gave their executive and medical officers opportunities for close observation. Apart from cases of psychosis, which will occur in all communities, and mental unfitness arising from defects in make-up or poor background, the factors responsible for neurotic affections could often be assessed by medical officers, particularly after they had acquired operational experience. A Technical Instruction on psychiatric first aid was also of value in making assessments. It described the common types of neurosis, stressed the need for carrying out a thorough examination and taking a full history, and set out the appropriate treatment in each case. In sending men to hospital during the early stages of a "battle" or "tropical" neurosis there was always the risk that the foundation might be laid for a chronic illness, and therefore, while there was need for prompt treatment, it was preferable that it should be begun in the sick bay.

Reference has been made to service in the tropics as a cause of physical and mental fatigue. When the environment was one of continuous heat,

and when this discomfort was multiplied by enforced blackout in dangerous waters, and consequent poor ventilation, strain of mind and body were to some extent inevitable. Tropical service *per se,* however, has probably been exaggerated as a factor in psychiatric disorders. There were other factors, such as the fear inseparable from the trials of aerial attack, domestic anxieties and discontent engendered by monotony and lack of leave and other amenities. In fact, the most uncomfortable and even dangerous surroundings were cheerfully borne over long periods when men were inspired by the challenging nature of their duties and by leadership of a high order. It was noticeable that complements of R.A.N. ships in the Mediterranean in 1939-41, though warned at the outset of their tour of duty that monotony would be their portion, maintained an excellent morale. On the Tobruk run, even when there was the added burden of patients in fighting ships, no complaints were heard. Again, it was possible for 300 men to live in the tropics on board an 1,800-ton destroyer like *Arunta,* with only one period of leave in a year, without loss of spirit. Numbers of medical officers, however, pointed out that it was desirable that sea-going service should bear a more or less fixed ratio to the period of total service. More than once it was found that some of the older hands could be relieved in their own interests and that of the Service. It was further noted that outbreaks of minor illness were more likely to depress the spirit of men who were psychologically tired.

An interesting survey of engine-room ratings with service of four years or longer was carried out by Surgeon Lieutenant H. B. Holmes in Darwin. Numbers of these men showed signs of anxiety states, including loss of appetite and weight, sleeplessness, and trembling of the hands. Holmes found that an undue proportion of them had had long sea service, which put them "out of phase with their surroundings ashore" even when they had leave. There seemed reason for believing that anomalies of drafting had made certain men display strain which was less evident in others more fortunate. Such physical factors as a good diet and good accommodation were also important in maintaining mental fitness, though these could not always be attained in ships at sea, particularly with the increased complements demanded by modern naval warfare. Many examples could be quoted, from the larger ships as well as the smaller. In H.M.A.S. *Canberra* the quality of food and availability of good amenities were noted to be significant in maintaining a high degree of mental health among the men. In H.M.A.S. *Perth* during 1941 the importance of rest was recognised, and an opportunity to give some of the men even a couple of days in a rest camp was found of great value.

Action conditions could precipitate mental breakdown. Shock and exhaustion states due to strain, chiefly though not solely mental, were observed both during and after action. Surgeon Commander J. M. Flattery described two contrasted types of neurotic casualties seen in *Australia*: those apart from action and those due to action exhaustion. He observed, as have other medical officers, that the latter kind often occurred in men of the type better than average. During the Leyte and Lingayen actions

the provocation to breakdown was extreme, as the ship was twice severely damaged and on one occasion was exposed to Japanese *kamikaze* attacks over a period of five days. All on board had an acute consciousness of being subjected to a new type of warfare, the suicide bomber. There was a fearful atmosphere of uncertainty. The men felt that their ship was singled out for special attack—a counter-attack on *Australia* in a double sense. Even if an enemy plane were 50 miles away, they were convinced that, among dozens of ships, it was coming straight for their own. After these assaults many exhaustion states were seen: men lost their grip, and cried out that they could stand no more.

In such circumstances it was difficult to treat large numbers of serious injuries and mental casualties as well. Prompt treatment was given, however, and it usually brought good results: the men were reassured that they had done their job faithfully, and an injection of not less than ½ grain of morphine was administered hypodermically, a lesser dosage being considered useless. Later, bromides were administered to some patients in doses which Surgeon Lieutenant A. H. Robertson said he would have described as huge in other circumstances. Once safer waters were reached nearly all these men could be returned to duty and most of them made good recoveries, but some could not resume work until 14 days after the attack. Flattery described 30 cases of this dramatic type of nervous exhaustion, and noted that most of them occurred on the fourth day of the Lingayen action. It will be noticed that this series of disturbances had a common origin, and were of an "infectious" nature.

Other instances of neuroses were seen at different times in different places: one may be mentioned by reason of its unusual cause. In February 1945 *Nizam* unexpectedly made a deep roll, recorded as 80 degrees; 10 men were swept overboard and lost, and one was injured. Surgeon Lieutenant A. R. Woolnough reported that numbers of men were affected by nervousness and insomnia as a direct sequel. Considerable sedation was given, to which they responded well, but evidence of the shock could be traced in some men for a considerable time. In these instances there would seem to have been a prolonged mental upset which retraced the alarming event.

The air raid on Darwin had produced similar features: the sudden alarm and severe damage, the group nature of the disturbance, and the unleashing of the psychic forces which call for emotional reactions, especially those of flight. Surgeon Lieutenant S. A. Sewell reported that medical officers were concerned by the number of psychological casualties, and he described as unfortunate the fact that the air raid shelters under the houses offered but limited protection. Those using these shelters could not see what was going on, and would have been much better and steadier if they were actually watching the raid.

A point to be remembered in assessing the results of dangerous threats to life and safety is that members of a disciplined Service should have an advantage, especially when they belong to an enclosed community, from which mutual help and strength can be drawn.

There is little to be said specially about psychotics in the navy. The patients seen followed the patterns observed in the army, and were in general, in accordance with the established organisation, transferred to army establishments. In New Guinea the problems of evacuation of psychotic patients to the mainland were the same as those encountered by the army medical corps. It was found necessary to retain and treat these men long enough and in such fashion as to minimise the risk and difficulty of air transport. Some naval patients were evacuated direct by air from shore installations; others were retained at the discretion of the army medical officers, and treated by cardiozol therapy before evacuation.

The states observed in survivors of shipwreck are described elsewhere, but as the experiences of the R.A.N. Medical Service were relatively limited compared with those of larger Services, further brief mention may be made of this form of traumatic war neurosis by reference to the problems of the Merchant Navy, whose seamen sometimes presented signs of emotional disturbance after the sinking of the ships in which they were serving. A most informative study was made by the psychiatric division of the department of neurology of the Mount Sinai Hospital, New York. Some of the men rescued after the sinking of their ship did not return to sea-going service; others, apparently recovered from what was often a dreadful ordeal, resumed their previous occupation. By voluntary interview it was possible to explore the mental state of numbers of the latter group, and to correlate to some extent their background and experiences when their ship was sunk with the psychological reactions which were observed in 75 per cent of them. The Mount Sinai findings emphasised that all rescued men were medical casualties, some with persistent and haunting memories from which might arise emotions of rage or guilt. They had to be handled with sympathy and gentleness, for early misunderstanding of their emotional reactions could well inspire a suppressed anger difficult to alleviate. The importance of mutual aid and first aid was stressed, and useful recommendations were made concerning the need for ship's drill, so that abandoning ship in darkness could be facilitated by preknowledge of the techniques of escape.

CHAPTER 17

THE DENTAL BRANCH

IN the early years of the 1914-18 War there was no organisation within the Royal Australian Navy for the dental treatment of officers and men. Urgent dental treatment was carried out by the medical officer with the aid of a student's case, and was confined to extractions and simple fillings. Usually men needing treatment were sent to various dentists in the capital cities of the Commonwealth and elsewhere as opportunity offered. Army dental services and the dental hospitals in Melbourne and Sydney also helped. When R.A.N. ships served overseas Royal Navy facilities were used.

In 1918 a dental surgeon was appointed to H.M.A.S. *Australia,* and this was the genesis of the R.A.N. Dental Service. When an Australian naval medical officer, Surgeon Captain L. Darby, was appointed Director of Naval Medical Services in 1927 the Dental Service of the Navy began to expand, and prosthetic facilities were provided for the first time.

At the outbreak of the 1939-45 War the R.A.N. had only nine permanent dental officers. The proposals of the D.N.M.S. for the formation of a reserve branch had been rejected, and the navy had some initial difficulty in obtaining the extra dentists it required to cope with its sudden expansion. Nor was it at first realised how great an increase of dental personnel and facilities would be required in the course of the war. The increase in the demand for dental work was unexpectedly large and was due to several factors, the principal ones being the lowering of the dental standard on entry, the rush of reserve men and recruits, many of whom were from a naval standard dentally unfit, and the deterioration of teeth during long service at sea, especially in the tropics. It was noted that tropical service had a deleterious effect on teeth as it had on skin. This was noticed particularly in small ships, and was probably due to vitamin deficiency in the food or water or both.

Suitable dentists for the naval service were obtained at first through purely naval channels and later through the Central Dental Committee, which allocated dental officers in the same way as the Central Medical Coordination Committee and the Service Directors' Committee allocated doctors. Of course, in comparison with other Services the numbers required by the navy were small: even at its peak the number of officers in the Naval Dental Service did not exceed 33.

There was also a shortage of dental mechanics and dental attendants. At the outbreak of war the R.A.N. had six dental mechanics only and no reserves. Recruits were obtained without much difficulty in the beginning, but towards the end of the war there was a serious shortage. This was relieved when the Army Dental Service set up its own training centre, and satisfactory recruits were obtained from this source. Prosthetic facilities were provided at all shore depots on the mainland, including Darwin;

at Madang, and at sea in the cruisers and in H.M.A. ships *Platypus* and *Manoora*. The total number of dental mechanics serving at the end of the war to cover the prosthetic requirements of over 39,000 members was 22.

W.R.A.N.S. joined up as dental attendants, and in one case as a dental mechanic. Like male dental attendants, they were trained in the medical and dental sections of Flinders Naval Hospital and at Balmoral Depot. They gave excellent service and were well adapted for work of this kind. The only objection to their employment was that they could not serve at sea nor, to any great extent, at tropical shore stations. Sick-Berth Attendants (D) had to be used in those spheres, and it became increasingly difficult to give them periods of service in home ports so that they could attend refresher courses and the like. It was necessary to have a minimum of one dental attendant to each dental officer, in addition to the people employed in clerical work.

With men scattered among some 580 ships and establishments thousands of miles apart, the navy had a more difficult problem than the other Services in providing adequate dental facilities, especially as Australians had become very conscious of the need for dental care. Surgeon Captain W. J. Carr remarked that the chief complaints from ships in the tropics appeared to centre upon the absence of beer, mail and dentists. The dental problem was eased somewhat by cooperation between the dental directors of the three branches of the defence forces, whereby each Service was able to make use of the facilities provided by the others.

At sea dental officers were carried in each of the five cruisers, but at first the dental needs of the armed merchant cruisers were not adequately met. Surgeon Lieut-Commander G. C. P. Courtney of *Manoora* wrote in December 1940, while the ship was on the Australia Station:

> Dental hygiene is a matter which requires serious consideration. It has been found necessary during the quarter to perform thirty-six extractions, and approximately the same number of temporary fillings. This work has been carried out only in urgent cases, as there is no Dental Officer aboard and opportunities for obtaining dental treatment ashore have been very few. A survey carried out at the end of the year shows that only one-third of the ship's company is dentally fit. Necessary work to be done among the remainder includes fillings or extractions of 407 teeth: fourteen ratings require prophylactic treatment (for gingivitis, receding gums, pyorrhoea) and eighty new dentures or remodelling or repair of existing dentures.

Surgeon Lieutenant S. A. C. Watson of *Nestor,* which was operating with the Eastern Fleet, reported in March 1942 that while the availability of dental treatment ashore varied from place to place, there appeared to be a shortage of dental officers on the station. On several occasions all those in *Nestor* who required attention were not dealt with as the time of the dentists in port had been booked up beyond the date of sailing.

Napier, which was also serving with the Eastern Fleet, was more fortunate, at least in the earlier stages of the war. Surgeon Lieutenant J. A. James reported in the last months of 1942 that 60 of the ship's company had sought dental attention, which at most ports of call had

been given generously and efficiently. A few of the crew were in pain and had to have extractions but, on the whole, dental officers had been impressed with the excellence of the men's teeth. At one port the services of an army dental van were obtained and this unit drove on to the wharf and treated 24 cases in three mornings. Three years later the position in *Napier* had deteriorated. In the early months of 1945 she had been engaged in bombardments of the Burma coast, and the medical officer found that R.N. facilities in the vicinity had been unable to provide the dental attention necessary. The result was that when she returned to Fremantle in March R.A.N. dental surgeons could not cope with the large numbers requiring dental treatment. When *Napier* left for operational areas after nearly three weeks in a home port, and with the prospect of being away for an indefinite period, 36 of her crew had not received dental treatment. Dental instruments were not even available to allow the medical officer to carry out emergency work, and the latter suggested that a set of dental forceps and a syringe be placed on scale for all destroyers.

Surgeon Lieutenant J. F. Rutter of *Nepal,* another Australian destroyer operating with the Eastern Fleet, reported in the first quarter of 1945: "Although every consideration has been given to the ship by dentists, particularly at Colombo, the dental condition of the ship's company is causing alarm." He did not think there was any complete answer to the problem but suggested that, if a dentist with a portable plant were appointed to a convenient ship or base, the position would be improved. Surgeon Lieutenant B. Oxenham of *Norman,* which was serving in this theatre, made the same suggestion. The personnel of *Norman* suffered severely from dental defects. Oxenham reported in the first quarter of 1945: "Recently sixty-four ratings applied for dental treatment. Of these, forty-six had gross artefacts of which they were themselves aware, and sixteen were in need of denture repairs or dentures. It can be deduced that a very large percentage of the ship's company who have had no dental attention for some considerable time have defects of which they are not aware." Dental facilities in the British Eastern Fleet were extremely inadequate. Only men with actual toothache were attended to, except at the occasional boiler-clean, and even then only a few appointments could be made as the overworked dentists in H.M.S. *Woolwich* usually had several destroyers to attend to at once.

The story was the same for small ships in other waters. Surgeon Lieutenant H. B. Holmes, the medical officer of *Nizam,* which had been serving with the Mediterranean Fleet on convoys to Malta, wrote in the second quarter of 1943: "A subject on which nothing good can be said is the dental facilities, or lack of them, in all ports visited. The dental officers are very eager to help and cooperate, but are handicapped by lack of staff and equipment. It has been almost impossible to get any denture work done."

For the crew of *Bowen,* operating on the Australia Station in the middle of 1944, it had been possible to arrange only two dental appoint-

ments for urgent extractions, although approximately one-third of the personnel borne were in need of fillings or other dental treatment. Appointments were sought in *Melville* immediately on arrival at that station, but the only appointments procurable were for the relief of urgent cases.

When *Manoora* was converted to a Landing Ship Infantry no dental officer was appointed. Surgeon Commander R. F. Matters, the medical officer, wrote in December 1943:

> Dental caries and insufficient mastication due to broken dentures and loss of teeth is becoming more serious every day in this ship, as the opportunities to get in touch with Dental Officers are very remote. When the ship is in the vicinity of an establishment or ship carrying a Dental Officer it is impossible for him to cope with the numbers requiring treatment either surgical or prosthetic: in a conversation with the Dental Officer of *Kanimbla* he stated that practically his whole time was taken up by his own ship's company. Also when troops are carried quite a number of them report complaining of toothache, which means less time available for appointments for the ship's company. It is therefore pointed out that a ship such as this with an average numerical strength of 620 would certainly benefit by the appointment of a Dental Officer.

In March 1944, being still without the services of a dental officer, Matters was forced to remove a number of teeth under local and ethyl chloride anaesthesia. Owing to the state of the teeth the patients suffered considerably, and Matters emphasised the necessity for a dental officer in a ship which from time to time carried almost 2,000 men.

His suggestion was carried out in 1944 and 1945 when one dental officer was appointed to each of the three landing ships (*Manoora, Kanimbla* and *Westralia*). These ships provided some dental facilities for the personnel of destroyers, corvettes, motor launches and other small ships working in the waters between New Guinea and the Philippines, but were not able to satisfy all the demands made on them. Consequently a dental officer with mobile equipment was appointed to the Destroyer Flotilla and moved from ship to ship as required. This experiment was successful, and appeared to be the best method of satisfying the dental needs of members of small ships working far away from shore bases.

A dental officer and his staff were also appointed to the depot ship *Whang Pu*. Surgeon Lieutenant N. L. Speirs reported in June 1944 that this had greatly increased the efficiency of the treatment that the ship could provide. The availability of someone capable of giving an anaesthetic was an added advantage, as it allowed the leading sick-berth attendant to be used as a theatre scout or assistant. Dental quarters were added to the ship by the conversion of a bathroom which was not in use.

As to shore establishments, it was found necessary in the course of the war to have at least 6 dental officers at Flinders Naval Hospital, 6 in the Sydney establishments, 2 each at Brisbane, Fremantle and Darwin and one each at Townsville and Cairns. In New Guinea a dental officer with a mobile outfit was appointed with instructions to proceed to whichever base most urgently needed his services. In the later stages of the war three dental officers were needed on shore in New Guinea: one was

appointed to both Milne Bay and Madang, and one was borne in *Platypus* for duty at Morotai.

The dental clinics at Flinders Naval Hospital (H.M.A.S. *Cerberus*) and at Balmoral, Sydney, were opened during the war and were well planned and organised. Six chairs were available in each, together with prosthetic and X-ray facilities and the necessary offices for clerical work. Both were maintained mainly by W.R.A.N. dental attendants.

A dental officer began treatment at *Harman,* Canberra, in the last months of 1943. On examination, he found that about 80 per cent of the serving personnel required attention because of the fact that no dental officer had visited the establishment previously. The general condition of teeth was poor, and there were a few outstandingly bad cases. Facilities for carrying out dental treatment were not adequate, and he recommended that a dental surgery should be included in the sick-bay building which was then about to be built.

Some difficulty arose over the supply of dental equipment on account of the varying types of voltage available. Shore depots as a rule were supplied with alternating current, ships with direct current; also the voltage in ships varied; in some it was 240 and in others 120. Consequently shore and ship units were not freely interchangeable. The first mobile units supplied were of the pedal variety, but in the tropics this was not satisfactory either for the operator or the patient, and at a later date electric power was used in all cases.

When the British Pacific Fleet arrived in Australia R.A.N. dental facilities were made available to it. Subsequently, however, a complete R.N. dental service was established in Australia.

CHAPTER 18

THE NAVAL NURSING SERVICE

OPINION was divided on the advisability of establishing a nursing service within the navy. For many reasons the idea seemed undesirable. As it was impracticable to have female nurses in sea-going ships or remote shore establishments, a male sick-berth branch was necessary, and its competency depended not only on training but also on opportunities for practice. If all specialised work were done by female nurses, the sick-berth staff would be found wanting in experience. However, this applied with most force to the members of the permanent navy, and these formed a limited proportion of the total under wartime conditions.

At the outbreak of war 59 sick-berth ratings were serving. More were required quickly, and they could only come from the reserve. This position had been foreseen during the pre-mobilisation period and, with the help of two instructors from the permanent forces, regular courses of instruction had been carried out in the reserve depots in Melbourne and Sydney, supplemented by actual medical work in out-patients' departments of civil hospitals. The result was that a well-trained body of reservists was immediately available for work as sick-berth ratings. However, in the first 18 months of the war the navy expanded more rapidly than was anticipated, and this involved increased demands for sick-berth ratings at sea and on shore: the required numbers could no longer be provided, and difficulty was also experienced in obtaining suitable recruits. Even if sufficient numbers of the latter had been forthcoming, time would have been necessary to turn them into efficient sick-berth attendants. Trained female nurses were already available, and while they could not be used at sea, they could relieve the nursing shortage in shore establishments and provide there a continuity of treatment such as was impossible with sick-berth attendants who were always likely to be drafted to sea. These considerations, as well as the demands of nursing organisations and relatives of sailors for the recruitment of female nurses, carried the day, and in October 1942 the Women's Royal Australian Naval Nursing Service was established.

Miss A. I. Laidlaw, who had served as an army nurse in the 1914-18 War, was appointed the first Matron, and nurses were selected by Surgeon Captain W. J. Carr in Melbourne and Surgeon Captain L. Darby in Sydney, the R.A.N.N.S. being confined initially to those cities. The regulations of the service were modelled on those of the army and air force. The army practice of using military titles for nurses was not followed in the navy, in which ranks were merely equivalent. The matron was given rank equivalent to that of lieut-commander; nurses on entry had the equivalent rank of sub-lieutenant, and on promotion that of lieutenant. Saluting, however, was obligatory, the R.A.N.N.S. being the only one of the three Australian nursing services in which this was so at that time.

The uniform designed for outdoors was a navy blue serge skirt and jacket, with buttons and rank stripes as for male officers, white shirt and collar, black tie and black felt hat, fawn stockings and black shoes, gloves and wallet. The rank stripe was maroon. Indoors, superintending sisters and sisters wore a medium blue dress and a white veil. The matron's dress was navy blue. In winter the matron and superintending sisters added a navy cape with a 2-inch scarlet border and sisters a navy cape with scarlet piping 2-inches from the edge. In summer when capes were not necessary shoulder straps with rank stripes were attached to the indoor uniform. Uniforms were provided by the navy, which also made recruits an allowance of £5 for the purchase of "intermate" (Navy Office spelling) garments.

The first R.A.N. nurses were not unnaturally a little timid as they entered the depots, for they were invading what had hitherto been an all-male service, and most of them spent their first week studying the "Bible", a mighty tome of naval rules and regulations. However, they quickly adjusted themselves, and were soon talking unaffectedly in the naval vernacular. The rooms in the hospital became "cabins", the floors "decks", the windows "scuttles", and they did not leave the hospital: they "went ashore".

At Melbourne 12 nurses under Matron Laidlaw took up their duties at Flinders Naval Depot. They lived in two cottages at the depot, where a third cottage was later made available to them as dining and wardrooms. Naval cooks attended to their meals. In their first weeks at Flinders the nurses found that they were really needed. Many of the recruits travelling from other States in the winter without adequate clothing contracted chills, and infectious diseases among them spread rapidly. At one time the nurses were in charge of five wards with approximately 150 patients. When the W.R.A.N.S. entered the depot a ward was made available for them, which added to the nurses' duties.

At Sydney, where Miss M. L. Rae had been appointed the Superintending Sister, there were some initial difficulties. At first the navy had no hospital of its own, and the nurses worked in two, and for a time three, wards of the Prince of Wales Hospital, Randwick, accommodation being provided for them in the quarters of the Repatriation Department sisters. Later, when the navy took over "Canonbury" as a hospital, Sister Rae, after much difficulty, succeeded in finding a cottage at Darling Point to serve as living quarters. At first the nurses received a victualling allowance, and were responsible for their own cooking and housework. This was a most inconvenient arrangement, and often a nurse who was needed at the hospital had to be sent home to prepare meals.

After they had been at Darling Point for about six months the Director of Naval Medical Services came to inspect the nurses' quarters. He was horrified to see fruit cases round the table instead of chairs, and almost immediately afterwards the navy took over the cottage; it was furnished properly, and a cook and W.R.A.N. stewardesses were provided. The

R.A.N. nurses in Sydney looked after not only Australian but R.N., Free French and American patients, the last only until their own hospitals were set up.

The service benefited greatly in 1943 when a limited number of physiotherapists and one biologist were admitted. They worked in Sydney and Melbourne.

The nurses took a prominent part in the training of sick-berth attendants. At Flinders Sister B. V. L. Swallow took over the theatre, where she supervised the training of S.B.A's in that exacting branch of their work.

Only one of the nurses was appointed to a ship. This was Sister J. E. W. Tame, who made a voyage to India in the hospital ship, *Manunda*. Numbers of them, however, served overseas. In April 1944, when the military position at Milne Bay had become stable, six nurses under Sister V. E. Kelly were posted there to take over a 40-bed ward at the R.A.A.F. hospital. Later the navy took over the hospital completely. The establishment then had to be refitted, a task for which naval organisation was not well adapted, but after unavoidable delay and difficulty, a satisfactory hospital unit was formed capable of taking 100 or even 200 patients in palm-thatched wards. The nurses, with sick-berth staff and other ratings, continued to work there under the direction of two medical officers for more than nine months. Other nurses were posted to the 110th Australian General Hospital, Perth, the naval sick-quarters in Brisbane, Townsville, Cairns, Canberra and Fremantle, and to the Kahlin Hospital, Darwin.

The sick-quarters at Brisbane, Townsville, Cairns and Canberra accommodated up to 25 male and 12 female patients, and also treated out-patients. Usually two sisters were stationed at each, and, as the more serious medical and surgical conditions were not treated there, all needs could usually be met. The navy took over Kahlin Hospital, the one-time civil hospital at Darwin, in 1945, and naval nursing sisters served there until the end of the war.

The influx of highly-trained nursing sisters into the navy presented problems to the officers called upon to administer hospitals and sick-quarters. Goodwill went a long way in avoiding friction, but more than that was required. It was always necessary to be on guard against relying on skilled female nurses and relegating the male staff to subordinate positions, which would obviously militate against efficiency at sea. It was found advantageous to place some wards in charge of petty officers, and to see that the operating theatre was not entirely the responsibility of a theatre sister, no matter how skilled she might be.

Although the number in the service never exceeded 60, there can be no question of the success of the naval nursing service, and that its members added to the general comfort and well-being of the sick and wounded in naval hospitals. The end of the war brought the question how many female nurses should be retained. This was a post-war problem, and its solution involved consideration of the role of reserves in the nursing service and the importance of encouraging a high degree of efficiency in the male staff.

PART II

MEDICAL SERVICES OF THE R.A.A.F.

CHAPTER 19

BETWEEN THE WARS

THE Royal Australian Air Force developed from the Australian Flying Corps, which until 1921 was part of the Australian Army.[1] At the end of the 1914-18 War the A.F.C. comprised three squadrons in France and one in Palestine. All units were disbanded when they returned to Australia, but in 1920 it was decided to raise some of them again to form an Australian air force. This was done in the following year. The new Service, which was based on Point Cook, Victoria, was named the Royal Australian Air Force, and on 1st September 1923 the Royal Assent was received to the Air Defence Act which gave the R.A.A.F. status equal to that of the Royal Australian Navy and the Australian Military Forces.

The medical service of the R.A.A.F. had a modest beginning. It was housed in a small hut which served as sick-quarters at Point Cook, and its sole medical officer was Squadron Leader A. P. Lawrence. Lawrence, who had served in the Australian Army Medical Corps in the war just ended, was appointed to the new air force in July 1921.

In addition to performing his normal duties as a medical officer, Lawrence began to take an interest in aviation medicine. He was particularly interested in the selection of recruits for flying training, and in the problems of high-altitude flying. In this latter connection he observed very closely the post-flight reactions of Flight Lieutenants A. T. Cole and H. F. De La Rue, who, without supplementary oxygen, flew a DH-96A to a recorded altitude of 28,000 feet. (The height reached was probably rather less than this, as the altimeter was not checked or corrected for high altitude recordings.) Lawrence noticed, when the aircraft reached the ground, that De La Rue was very cyanosed, and that both pilots showed other signs of recent oxygen lack. Both were somewhat unwell for a few days afterwards. Lawrence also wished to observe his own reactions at high altitudes, and he persuaded Squadron Leader W. H. Anderson to take him up for the purpose. This flight was again made without supplementary oxygen. At a recorded altitude of 22,000 feet Lawrence noted in himself signs and symptoms of considerable oxygen lack, and realised that he was incapable of making accurate observations. These rather haphazard experiments can be said to mark the beginning of work in aviation medicine in Australia.

By 1922 the air force had expanded somewhat, and the need was felt for a medical officer on the headquarters staff at Victoria Barracks, Melbourne. Squadron Leader Lawrence was given this appointment with the title of Director of Air Force Medical Services. The post of medical officer at Point Cook was filled by Dr G. F. Cherry who had the rank

[1] Lieutenant G. P. Merz, one of the four officers who qualified at the first course of war-flying in Australia, was a medical practitioner. The course began on 17th August 1914. The other graduates were Captain (later Group Captain Sir Thomas) White, Lieutenant (later Air Marshal Sir Richard) Williams, and Lieutenant (later Captain) D. T. W. Manwell. Merz was killed in action in Mesopotamia on 30th July 1915.

of flight lieutenant. Squadron Leader Lawrence had only a small staff, and the Director-General of Army Medical Services advised him that until the air force expanded further it was proposed, for the sake of economy, to use existing army machinery as far as possible.

In 1922 a conference was held, with the Chief of the General Staff as chairman, which considered among other matters the question of the amalgamation of the naval, military and air medical services. After this, a sub-committee was appointed consisting of Surgeon Captain E. T. P. Eames, the Director of Naval Medical Services; Major-General Sir Neville Howse, Director-General of Army Medical Services; and Squadron Leader Lawrence. This sub-committee, under the strong personal influence of Howse, recommended to the Minister for Defence on 11th July 1922 that one medical corps should provide the medical service required by the three defence forces. The chiefs of the naval and air force medical services were not, however, enthusiastic about the plan, and it remained in abeyance until September 1925, when the Minister for Defence ordered the conference to reassemble to advise further on the proposal to amalgamate the three medical services. The First Naval Member, Rear-Admiral P. H. Hall-Thompson, circularised members of the conference, objecting to amalgamation on the grounds that it was impracticable, and offering as an alternative close cooperation between the three medical directors. Squadron Leader Lawrence also prepared a statement for the Air Board, withdrawing his agreement to the recommendations of the original sub-committee and advocating cooperation instead of amalgamation.

The conference met on 9th November 1925. It decided that amalgamation was not feasible, and a sub-committee was appointed to suggest means of improving the administration of the three medical services. It consisted of Colonel T. J. Thomas, chairman, and the three directors of medical services—Surgeon Captain C. A. Gayer Phipps (navy), Major-General G. W. Barber (army), and Squadron Leader Lawrence (air force). The sub-committee submitted a report on 11th November 1925 advocating cooperation, while a minority report by the Director-General of Army Medical Services pressed for amalgamation.

The Directors of the Naval and Air Force Medical Services considered that amalgamation would lead to inefficiency without resulting in any substantial economy. They contended that each of the Services had medical problems peculiar to itself, and that each should therefore continue to have its own directorate. They suggested that the Service boards should organise the existing directors into a Defence Medical Advisory Committee, to meet at least quarterly but more often if necessary, for the purpose of considering medical matters of common interest. The proposed committee, as its title implied, would be purely advisory, and its proposals would be subject to ratification by the Service boards concerned. Phipps and Lawrence pointed out that the Director-General of Army Medical Services, while adhering to his preference for unification and considering it quite feasible, nevertheless conceded that the proposed scheme would be an improvement on existing conditions. It would, moreover, be in

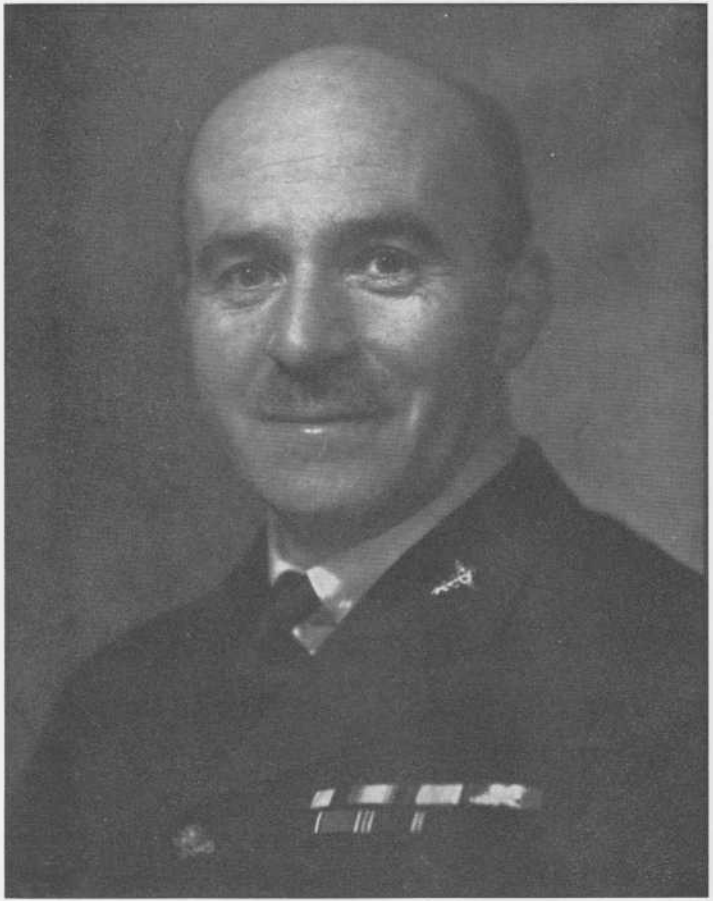


(*R.A.N.*)

Miss Annie I. Laidlaw, seated, Matron of the Royal Australian Naval Nursing Service.



Superintending Sister Mabel L. Rae in outdoor uniform.



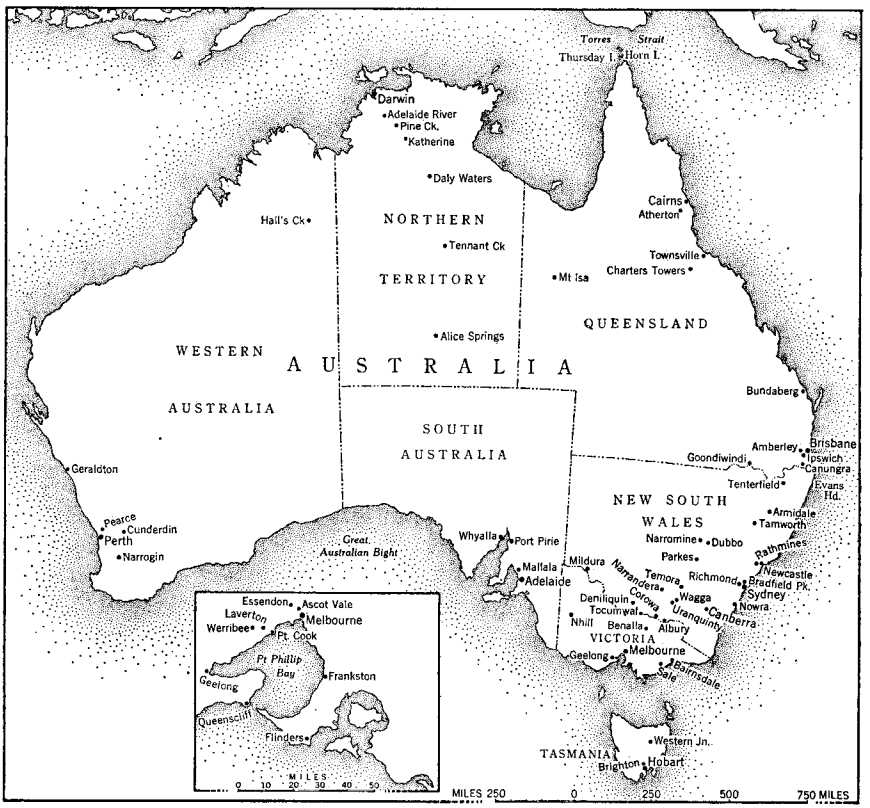
Air Vice-Marshal T. E. V. Hurley, Director-General of Medical Services, R.A.A.F., 1940-45.



Air Commodore E. A. Daley, Director of Medical Services (Air), 1938-40 and Deputy Director-General of Medical Services, 1942-45.

general accordance with the principle laid down in the *Manual of Combined Naval, Military and Air Force Operations* (1925), subscribed to by the British Admiralty, Army Council and Air Council. The proposed committee would examine the entire field of naval, military and air force medical activities, from time to time formulating proposals for improvement and suggesting the administrative arrangements necessary to give them effect.

The two medical directors instanced three items to which the committee, if appointed, might be asked to give immediate attention. These were:



(i) hospitals on land; (ii) shore personnel; and (iii) medical stores. In the case of the first, there did not appear to be any objection in principle to the hospital accommodation and facilities of any one of the Services being available to the other two. There was, of course, the difficulty of location. The naval hospital at Flinders, the army hospital at Queenscliff and the air force hospital at Point Cook were each so located as to be of little potential use to the other two Services. But should an army casualty occur near Flinders or an aircraft crash in that

vicinity, then the Flinders Naval Hospital could be used by the army or air force, and in the same way the army and air force hospitals would be available to the other Services. The army was not organised for operations north of the Tropic of Capricorn, and the war preparations of the navy might therefore contemplate the provision of a hospital ship in the waters to the north of Australia which would be available to the other two Services, but south of the Tropic of Capricorn the navy would look to the army and air force to provide it with hospital accommodation on land. It might also be possible for some coordination to be effected between the navy and air force in the northern part of Australia. The establishment of a Defence Medical Advisory Committee charged with the duty of bringing about coordination would ensure, it was stated, that all medical matters of common interest were carefully investigated, and would thus avoid any hiatus or, conversely, any overlapping either in the peacetime activities or the war plans of the three Services.

The sub-committee's report was considered by a Royal Commission on Health (1925), along with a separate submission by Major-General Barber, who detailed an administrative plan for coordination rather than amalgamation. The Royal Commission recommended that:

(1) the medical services of the Repatriation Commission should remain as at present;
(2) the medical services of the army, navy and air force should be coordinated under one director-general, with a sub-director in each Service;
(3) a consultative board should be established, consisting of the Director-General of the Defence Medical Service, the Director-General of Health and the Principal Medical Officer of the Repatriation Commission, to devise methods and means of cooperation between the medical services.

The Minister for Defence considered this report, and in September 1927 ruled that the Director-General of Army Medical Services should be responsible to the Air Board for the administration and control of medical and dental services in the R.A.A.F. from 1st October 1927. The Air Board submitted a minute to the Minister in November, protesting against the decision, but the Minister gave instructions that his ruling was to be put into effect immediately. As a result, Standing Orders for the R.A.A.F. Medical Service were produced by the Director-General of Army Medical Services. Wing Commander Lawrence's commission in the Permanent Air Force was terminated on 24th September 1928, and next day he was appointed to the Citizen Air Force, still with the rank of wing commander, to be part-time Deputy Director of Medical Services (Air).

When the Director-General of Medical Services assumed control of the R.A.A.F. Medical Service it consisted of two full-time medical officers, flight lieutenants with short-service commissions, stationed at Laverton and Point Cook; and several Citizen Air Force medical officers, flight lieutenants who did part-time duty at Richmond and in camps with the Citizen Air Force squadrons at week-ends. There was also one full-time dental officer on a short-service commission who worked at Laverton,

Point Cook and at Headquarters in Melbourne. In December 1928 the following officers held appointments:

Wing Commander A. P. Lawrence (C.A.F.): D.D.M.S. (Air)
Squadron Leader R. B. Davis (C.A.F.): D.A.D.M.S. (Air)
Flying Officer J. J. Swift: Medical Quartermaster
Flight Lieutenant W. D. Counsell: Medical officer, Point Cook
Flight Lieutenant E. A. Daley: Medical officer, Laverton
Flight Lieutenants S. C. Steele and G. P. Arnold (C.A.F.): Part-time medical officers, Richmond

During the next two years the gradual growth of the air force and the special nature of the problems of aviation medicine, in particular those met with in assessing the fitness of recruits for flying duties, necessitated the appointment of further full-time officers on short-service commissions, and also, in Sydney and Melbourne, of part-time specialists, both physicians and surgeons.

The air force was reduced in size during the economic depression of the early nineteen-thirties, but in 1933 the reverse process began and in the estimates of 1935-36 there was provision for considerable expansion. Further appointments of full-time medical officers on short-service commissions were made, including one at Richmond; the senior permanent medical officer, Squadron Leader Daley, now divided his time between the Medical Directorate, where activity was increasing, and his duties at Point Cook.

Sick-quarters had been established at Point Cook, Laverton and Richmond, where ordinary sick parades were held, and medical attention given to members of the air force and to their wives and families living on the stations. Preliminary surgical treatment was also given in the case of accidents. Nursing was carried out by male orderlies. If major hospitalisation or special investigation was required, the hospitals of the Repatriation Commission were used.

There had been no direct liaison between the R.A.A.F. and the R.A.F. on questions of air force medical organisation since 1924. With rapid developments taking place in this field, it seemed desirable that a definite link should be established, but the fact that the R.A.A.F. Medical Service was administered by a part-time D.D.M.S., who also had his private practice to consider, presented a serious obstacle. The situation was brought to a head when Group Captain Lawrence submitted to the Air Board that he and Squadron Leader Daley should go to England on exchange to the R.A.F. This proposal was rejected by the board, and Group Captain Lawrence tendered his resignation, at the same time recommending that Squadron Leader Daley should be sent. The resignation was accepted, and also the recommendation that Daley should go to England, the intention being that he should gain additional experience before taking up full-time duties as D.D.M.S. (Air).

Meanwhile, Colonel R. Fowler was seconded from the army to be Deputy Director of Medical Services (Air), with the rank of group captain. Fowler proved to be a far-sighted administrator, and during the

period of his secondment, which began on 1st February 1936, he focused attention on such aspects of air force medicine as the evacuation of casualties by air and the problems of warfare in tropical areas. To increase the scope and activity of the Air Force Medical Service he arranged that more surgical work should be carried out at the various R.A.A.F. stations, where the sick-quarters were well equipped for the purpose. Hitherto, as already mentioned, the policy had been to send all major cases to repatriation hospitals.

Fowler also added to the number of part-time specialists. In 1929 a consultant physician and a surgical consultant had been appointed to the Citizen Air Force in New South Wales. In August 1936 Squadron Leader E. T. Cato was appointed as a surgeon specialist and Flight Lieutenant N. E. H. Box as an ear, nose and throat surgeon on the staff of the D.D.M.S. (Air). Flight Lieutenant G. E. Phillips, a neuro-surgeon, was attached to the squadron at Richmond in July 1937, and Flight Lieutenant C. H. Hembrow, a surgeon, was made a squadron medical officer in August. In order to have the R.A.A.F. Medical Service represented in Queensland, where for a long time there had been no permanent air force unit, Dr S. F. McDonald, an authorised medical examiner of the Department of Civil Aviation, was appointed to the reserve in March 1937. He was available for advice and consultation.

Fowler relinquished his appointment on 15th July 1937, and an R.A.F. medical officer on exchange, Squadron Leader G. S. Strachan, took over his duties until Daley returned on 4th July 1938. Daley was then appointed D.D.M.S. (Air) with the rank of wing commander. In January 1939 the title of Deputy Director of Medical Services (Air) was changed to Director of Medical Services (Air), but the extent of responsibility remained unchanged.

From 1921 to 1928 the medical authority appointed as Director of Medical Services R.A.A.F. had also been adviser to the Controller of Civil Aviation on medical matters. In 1928, with the placing of the air force medical service under the control of the D.G.M.S. (Army), civil aviation matters, theoretically at least, also came under his control. In practice, responsibilities in respect of the Department of Civil Aviation were delegated to the D.D.M.S. (Air).

The Department of Civil Aviation had throughout Australia a number of authorised examiners who medically examined applicants for private and commercial flying licences. They included general physicians, and eye, ear, nose and throat specialists. The D.D.M.S. was an examiner, but in Air Force Orders was referred to as the Medical Assessor. The recommendations of the other examiners as to an applicant's fitness to hold a flying licence were referred to the Medical Assessor for confirmation or otherwise. The Medical Directorate held the medical records of civil as well as of Service pilots.

It will be seen that the Medical Assessor was responsible for ensuring safety in civil flying so far as the medical aspect was concerned. Australia, as a signatory to the International Convention of Air Navigation,

conformed to the standards laid down by the convention, and the Medical Assessor applied these standards in determining the necessary safeguards.

There was thus from the earliest days a very close link between the air force and the Department of Civil Aviation. The rapid transfer of civil pilots to the Service and vice versa was facilitated because there was one medical authority familiar with the standards of both and because the two sets of medical records were under one roof.[2]

[2] Later, however, rapid wartime expansions and other factors concerning personnel, records and location, affected the previous, relatively smooth, peacetime application of this arrangement. A direction to medical officers regarding the relationship was issued in 1945, and at the same time an attempt was made to have clarified the role of the RAAF Medical Directorate in the rapidly increasing activities of the Department of Civil Aviation.

CHAPTER 20

WARTIME ORGANISATION

WHEN war was declared in September 1939 all three Services were faced with a volume of urgent administrative work. The Director-General of Army Medical Services, Major-General R. M. Downes, was absent from Australia, but in any case he would probably have had difficulty in coping with the medical administration of the R.A.A.F. in addition to that of his own Service. Under the arrangement made in 1927 the Director-General of Army Medical Services was responsible to the Air Board for:

(*a*) the organisation and administration of the medical services of the air force;
(*b*) medical statistics and reports;
(*c*) hygiene;
(*d*) confirmation of proceedings of medical boards;
(*e*) medical attendance and expenses not covered by regulations and claims for compensation on account of injuries or disease; and,
(*f*) in collaboration with other branches, for
  (i) first appointments, promotions, transfers, postings, resignations and retirements of officers of the medical branch;
  (ii) defence schemes and mobilisation relative to medical services;
  (iii) estimates of expenditure for medical and dental services; and
  (iv) construction of buildings for medical and dental services.

The Air Board pointed out that the air force had grown, that it now had a Director of Medical Services who had spent two years with the R.A.F., and that continuance of army control would cause delays. The board recommended that the D.G.M.S. (Army) be no longer responsible for the matters listed in paragraph (*f*) (i), (ii) and (iii) above. On 14th November General Downes, who had just returned to Australia, replied that the proposal in some respects conflicted with the policy of unification of medical matters in the three Services. He added:

> With the exception of first and higher appointments of officers, which should be made after consultation with D.G.M.S. as part of the coordination of appointment to the Services, personnel matters could well be dealt with directly by the D.M.S. (Air).
>
> Defence schemes should be submitted to the D.G.M.S. as military units are responsible for evacuation of casualties from the R.A.A.F.
>
> The question of estimates of expenditure would appear to be one that the D.M.S. (Air) could deal with without reference to the D.G.M.S.
>
> In all medical matters other than policy direct access to the D.G.M.S. and his staff is available without delay.

When Air Chief Marshal Sir Charles Burnett of the R.A.F. became Chief of the Air Staff in Australia early in 1940 he too felt dissatisfaction with the administrative control of the air force medical service. He informed Downes that he intended to make a submission to the Minister for Air advocating a separate R.A.A.F. Medical Service, and invited his comments. Downes replied on 1st March 1940, listing what he considered

were the advantages to the R.A.A.F. of the existing arrangement: the Army Medical Directorate already included a number of specialists whose services were available to the R.A.A.F. Medical Service; there was no competition between the Services for medical personnel; and there was economy of effort and funds in the provision of medical equipment. He considered that the proposed changes would mean that the R.A.A.F. Medical Service, which had only a few specialists, would compete with the army for medical personnel and also for equipment, the price of which would then rise. He added that the organisation of the R.A.A.F. Medical Service was inadequate.

Burnett then made a submission to the Minister for Air, replying to Downes' comments and concluding:

> I am only too ready to get the advice of either of the senior Services, but I feel that . . . a separate medical service is as necessary as the Service itself. Coordination can, as in the past and as in the other Services at Home, be well maintained by a Committee of the Directors of the three Medical Services under a Standing Committee.

As a result the War Cabinet on 5th April 1940 approved the following recommendations:

(*a*) That the D.G.M.S. (Army) relinquish his responsibilities in the control of the air force medical service.
(*b*) That medical matters requiring coordination between the navy, army and air force be dealt with by a standing committee consisting of the permanent medical directors of the three Services.

It is interesting to note that first Canada and later New Zealand had to face the same problem in connection with the air force medical service. Australia, however, enjoyed the advantage of having in existence an air force medical service, whereas Canada and New Zealand had to create theirs after the outbreak of war.

Sir Charles Burnett approached Dr Victor Hurley and offered him the appointment of Director of Medical Services with the rank of air commodore. Hurley had had varied service in the Australian Army Medical Corps in the war of 1914-18 and for a time had been Assistant Director of Medical Services at A.I.F. Headquarters in London. He accepted the appointment in June 1940. The recommendation was that the position be known as "Director-General of Medical Services", but through some oversight it was actually gazetted as "Director of Medical Services". This was rectified on 8th January 1943. Group Captain Daley was appointed Deputy Director of Medical Services.

In July 1940 an R.A.A.F. Nursing Service was established, with Miss M. I. Lang, previously of the Victorian Police Hospital, as its Matron.

About this time full details of the Empire Air Training Scheme became available. So that the necessarily rapid expansion would not be hindered by administrative delays, Hurley appointed additional staff officers and proceeded to reorganise the Medical Directorate. On the advice of Daley, reorganisation was along R.A.A.F. lines.

The reorganised directorate contained a Personnel Section under Group Captain W. D. Counsell; an Equipment Section under Wing Commander S. F. Reid; a section concerned with medical records, buildings, hospital matters, medical books and publications under Wing Commander J. A. Game; and a section for research under Wing Commander J. Grayton Brown. On 30th June 1942 a section was formed to deal with problems of hygiene and tropical medicine, which were becoming pressing in the South-West Pacific Area, and Wing Commander A. H. Baldwin was appointed to head it. This post was eventually to carry the title of Director of Hygiene and Tropical Medicine.

When the Women's Auxiliary Australian Air Force was formed in March 1941, Hurley decided that a medical officer should be allocated to supervise its working conditions and hygiene arrangements. Squadron Leader Mildred Hutchings, who was then serving in the R.A.A.F. as a medical officer on general duties, was posted to headquarters with responsibility for certain medical aspects of working conditions, particularly those in dangerous trades, such as ones in which dope and radio-active paint were used.

Group Captain N. H. Andrews was the senior dental officer. In March 1943 he was given the title of Director of Dental Services, and a separate Directorate of Dental Services was established under the supervision of the Director-General of Medical Services and as part of his staff.

At the outbreak of war Air Force Headquarters, including the Medical Directorate, was located at Victoria Barracks, Melbourne, but this accommodation soon became inadequate and part of the headquarters including the Medical Directorate moved to "Kellow House" in St Kilda Road. In the course of the war the headquarters continued to expand, and many further moves were necessary. The final wartime location of the directorate was the new barracks built in Albert Park to accommodate the various branches of the Services which had previously occupied buildings taken over from schools and commercial firms. The Directorate of Medical Services, with the rest of the branch of the Air Member for Personnel, moved there in December 1943. These moves were disrupting, while the fact that parts of the headquarters were so scattered made it difficult for members of the different branches to hold personal discussions. Hurley tried to overcome the latter difficulty by holding a weekly conference of his staff officers, and himself attended a weekly conference of the R.A.A.F. Headquarters directors presided over by the Chief of the Air Staff.

In accordance with the War Cabinet minute of 5th April 1940, a standing committee consisting of the permanent medical directors of the three Services was set up as part of the machinery of the Department of Defence Coordination. This committee met frequently throughout the war.

At the outbreak of war the R.A.A.F. Medical Service consisted of 8 medical officers on full-time service, and 18 who were members of the Citizen Air Force and attended training camps every alternate week-end

at Laverton or Richmond. Specialists who were members of the Citizen Air Force were available for consulting work in Sydney and in Melbourne. The service was thus a small one, and there was no large reserve available for call-up.

After 3rd September 1939 members of the Citizen Air Force and other medical men who volunteered were called up for full-time duty. The number of early volunteers was small owing to the uncertainty felt at that time about the part to be played by the R.A.A.F. in oversea campaigns. No definite promise of oversea service could be given, and no large hospital units were planned which would attract specialists. The army, on the other hand, was calling up numbers of reservists, including many specialists who could look forward to full-time work in their specialty at hospitals at home and overseas.

Recruiting continued in this atmosphere of uncertainty until the role of the R.A.A.F. was determined at the Ottawa Conference on the Empire Air Training Scheme in November. It was then seen that the R.A.A.F. would require large hospital units in Australia, and as R.A.A.F. squadrons began to be sent or to be formed overseas medical officers would be posted to them. When it became widely known that the air force would be sending medical officers overseas in increasing numbers, recruiting was greatly stimulated. Later, in the South-West Pacific Area, field hospitals known as Medical Receiving Stations and Medical Clearing Stations, were formed for service under action conditions. These units, together with the R.A.A.F. hospitals formed on the mainland, required a number of specialists, particularly physicians and surgeons, but great difficulty was found in obtaining them as so many had already joined the army, and those remaining in civil practice were urgently needed there. Hence, younger men with recent post-graduate qualifications were appointed to fill most of these positions.

In March 1941 State committees, on instructions from the Central Medical Coordination Committee established before the war, formulated plans for the economical allocation of Australian medical manpower. Each medical practitioner who was liable for compulsory service, or who desired to volunteer for service, was required to complete a form, indicating the order of his preference for the three Services and whether he wished to serve overseas. The intention was that the form would be completed by medical practitioners before they offered their services, and the State Committee would give an opinion whether they could be spared from civil practice. The completed forms would then be passed to the Central Medical Coordination Committee to be considered by the medical directors of the three Services, who would, if possible, allocate each medical man according to his preference and the requirements of the Service concerned.

The opinion of a State committee that a man could not be spared from civil practice, although not binding, was usually respected by the directors. This system ensured that:

(*a*) civil medical services were not unnecessarily denuded of medical officers;
(*b*) the Services received medical officers in proportion to their needs;
(*c*) each medical practitioner was appointed to the Service he preferred, if at all possible.

Considerable disruption of this scheme was caused when the Deputy Directors of Medical Services (Army) in certain States, acting unilaterally, exerted pressure on new graduates to apply for commissions in the Australian Army Medical Corps by stressing the fact that they were liable for compulsory service under the *Defence Act*. They were told that they might volunteer later for the navy or the air force, but they were frequently called up by the D.D.M.S. before they could complete their application for one of the other Services. Some recent graduates felt strongly that they were being handled in an unnecessarily severe manner by their professional colleagues in the army. However, after some changes of army staff, this practice was discontinued, and the system ran as intended.

From 1942 onwards the R.A.A.F. Medical Service was very popular among recent graduates. Many more applications were received than could be accepted, and the surplus was referred to the Director-General of Medical Services (Army). All recent graduates were accepted for service in the armed forces, but Air Vice-Marshal Hurley laid down a policy that no medical officer was to be called up for the R.A.A.F. until he had completed at least nine months after graduation as a resident medical officer in a civilian hospital. In addition, medical officers were allowed, if possible, a further 12 months' experience as senior residents or registrars in a specialised hospital before call-up.

By late 1944 the requirements of the Services for medical officers had been filled to a reasonable extent, but the civilian medical services, which had had few replacements during the four years of war, were in desperate need of more doctors. These doctors could be obtained only from recent graduates or by releases from the Services. The medical directors of the Services considered that it would be unwise for various reasons to allow recent graduates without any war service to proceed direct to private practice, and it was agreed therefore that a definite number of medical officers should be released from the Services each year to enable them to resume or begin private practice. In determining who should be released, age and length of service were taken into consideration.

With the release of the Air Force Medical Branch from army control and the development of R.A.A.F. hospitals, the practice of appointing part-time specialists and consultants to the Citizen Air Force was gradually extended throughout the capital cities of the Commonwealth. In certain country districts where there were air force units, local men were appointed for duty according to their qualifications, sometimes carrying out their work at the local hospital, where they might be honorary or part-time surgeons or physicians. The final establishment of part-time specialists provided for two consultant physicians, two consultant surgeons, one consultant pathologist, and numerous specialists in practically every branch of medicine and surgery.

In the early stages of the war R.A.A.F. medical officers were attached to No. 1 Recruiting Centre for initial training, which included paying visits to the R.A.A.F. station at Point Cook for instruction in sick-parade and orderly-room procedure, disposal of sick personnel, and sick-quarters administration. It was soon realised that this type of training was inadequate, and in April 1940 the then D.M.S., Wing Commander E. A. Daley, and the Director of Training, Wing Commander F. R. W. Scherger, arranged that a separate section under the direct administration of the Headquarters, R.A.A.F. Station, Laverton, should be established for the intensive training of medical officers and nursing orderlies. Soon after the establishment of the new section from 10 to 15 medical officers and from 15 to 20 nursing orderlies were being posted to Laverton each week for training courses.

The medical officers arrived at Laverton at intervals of one week for a course divided into a senior and a junior division, each of which lasted two weeks. The course included lectures on the general structure of the R.A.A.F., Service custom and procedure and equivalence of ranks, organisation of command headquarters and the Medical Branch, detailed administration of station sick-quarters and general principles of administration of the various types of unit—flying and ground-staff training units, recruiting centres, aircraft depots, operational squadrons and so on. Also dealt with were such other administrative and general Service matters as recruiting and recruiting standards, R.A.A.F. and R.A.F. publications, pay and allowances, courts of inquiry and courts martial, medical boards, medical categories and reclassification of officers and airmen, medical aspects of special trades, custody and issue of dangerous drugs, medical fitness and other specified returns, the area medical officer system, aspects of domiciliary attendance and lines of evacuation and disposal of casualties. In the clinical field, lectures on the various standard types of medical examination, clinical investigations, emergency surgery and management of aircraft accident casualties and V.D. prophylaxis were given.

In July 1943 it was decided to form a separate unit for medical training. In the same month a training centre was established at "Larundel", a spacious brick building in large grounds, 12 miles from Melbourne, recently built for the Victorian State Government as a mental institution. There Squadron Leader J. K. Gabriel and Flight Lieutenant H. G. Hiller completely reorganised the training program. Visual education was used to the utmost, the unit possessing a museum which contained medical, surgical, fracture and transfusion panniers, different types of first-aid and crash kits, a display of various rations, jungle and dinghy kits, insect specimens of medical interest, paintings and drawings pertaining to surgery and to tropical and temperate zone medicine, and varied photographs of R.A.A.F. medical work and units. There was also a section for enemy medical equipment.

All hygiene instruction was carried out during four days spent at the Hygiene Training Camp near "Larundel", which was declared an operational training unit. This camp was built, almost entirely from salvage,

by the Medical Training Unit itself. There were many working field exhibits for both static and mobile units, and officers were instructed in such matters as building latrines, constructing and maintaining grease-traps, water purification, malarial control methods, elementary plumbing and carpentry.

To make the medical officers "regimental", set periods of drill were held, and they were required to take part in the various parades of the unit.

In addition to the general service medical training carried out at the Medical Training Unit, courses were made available in special subjects. The R.A.A.F. Medical Service was very short of certain specialists, particularly those in fields removed from the run of general practice, such as pathology, hygiene, tropical medicine and plastic surgery. There was also a shortage in other specialties such as radiology and psychiatry. The army, which was experiencing similar shortages, arranged for courses of instruction to be held in these subjects, and the air force was invited to send a certain number of medical officers to each course.

Courses in hygiene and tropical medicine which lasted about two weeks were conducted by the School of Tropical Medicine at the University of Sydney for medical officers likely to be posted to tropical areas. In addition to provision of these short courses, the Service undertook to give a limited number of medical officers full training in tropical medicine. This training consisted of a three-months course at the University of Sydney, at the end of which those attending were eligible to sit for the examination for the diploma of tropical medicine.

The army trained some radiologists, but the number of courses was too limited to enable many R.A.A.F. medical officers to be included. An arrangement was therefore made whereby medical officers on leave without pay were lent to the Melbourne Radiological Clinic to serve a sort of apprenticeship during which they assisted the clinic's practitioners while themselves receiving training. The Royal Australian College of Physicians offered to train a certain number of medical officers in psychiatry, and three R.A.A.F. officers attended this course.

Colonel B. K. Rank, A.A.M.C., who had studied plastic surgery in England and who had been in charge of a facio-maxillary and plastic centre in the Middle East, returned to Australia in 1942 to organise a plastic surgery unit at No. 115 A.G.H., Heidelberg. After a discussion between Colonel Rank and Air Vice-Marshal Hurley it was agreed that most major plastic surgery for all three Services could be carried out by army specialists who had received their training in England, but that the air force needed a number of young surgeons trained in the elementary principles of plastic surgery, particularly in wound preparation and skin grafting, and a few more senior surgeons trained extensively in plastic surgery.

Hurley made it a cardinal principle that medical officers should not remain too long in any one post; a minimum of six months and a maximum of twelve was the rule. This policy maintained the enthusiasm

of medical officers by giving them frequent opportunities to break new ground, and those in uninteresting posts had the expectation of relief after a reasonable time; it also enabled numbers of medical officers to refresh their knowledge of clinical work during service at R.A.A.F. hospital units.

After their initial training course medical officers were posted successively to units in the base areas, including at least one flying unit, in order to give them experience in as many aspects of R.A.A.F. medical work as possible before going to operational areas. The total number of air force medical officers was small enough to allow a certain amount of individual attention to be given.

Establishments provided for a squadron leader as senior medical officer of the larger units, and additional station or unit medical officers on the basis of approximately one per 500 men. Provision was also made on the establishment of each flying squadron for one flight lieutenant as squadron medical officer, and while the squadron was lodged on a station he was to be included in the list of station medical officers. Establishments in the other units throughout the air force were on the basis of one medical officer to 500 men. At the same time, provision was made on R.A.A.F. establishments for about 90 nursing sisters.[1]

From time to time establishments were altered to meet the requirements of a rapidly expanding Service. However, certain principles were used as a guide. For instance, a medical officer was not included in a unit below a strength of 250, unless it was to be stationed in a remote place beyond the reach of civilian medical assistance.

In flying units such as the Service Flying Training Schools where the total establishment approached 2,000, the Senior Medical Officer was given the rank of squadron leader; later, at some of the largest permanent stations, including Laverton, Point Cook, Richmond and No. 1 Engineering School, the Senior Medical Officer was a wing commander. In the hospitals the commanding officer was a wing commander and the senior physician and senior surgeon were squadron leaders. The same principle applied to medical receiving stations. Only those medical officers with considerable experience at flying schools, who had carried out special courses in aviation medicine at the Flying Personnel Research Units, and who were considered capable of winning the confidence of aircrews, were appointed squadron medical officers. Later, so that the more experienced squadron medical officers could be retained on these duties, the establishment was raised to squadron leader in multi-engined squadrons. As the Service grew, the establishments for the Principal Medical Officers of the larger formations were up-graded to group captain. In the hospitals medical officers were provided on an approximate basis of one to 50 patients. These establishments and all others were always strictly comparable with the army establishments.

The total establishment of medical officers towards the end of 1944 had reached nearly 580. At the end of the war the total establishment was:

[1] The story of the nursing service is told in a later chapter.

1 air vice-marshal, 1 air commodore, 8 group captains, 38 wing commanders, 190 squadron leaders, and 270 flight lieutenants on the full-time active list, in addition to the consultants and part-time specialists; pharmaceutical officers numbered 57, and there were 9 entomologists and 13 hygiene officers.

At the outbreak of war all nursing in the R.A.A.F. was carried out by males. Medical orderlies, then known as "nursing orderlies", were recruited from civilians who had had some degree of training and experience in medical or nursing procedures. Applicants included ambulance officers, trained mental nurses, hospital assistants, surgical dressers, chemists, first-aid men from industry, medical students, and in one case a veterinary surgeon. Intake was about 15 a month. Orderlies were given the standard six-weeks drill course for recruits, after which they were posted to Laverton for a six-weeks trade training course. They were then posted to units as required for duty in medical sections and sick-quarters.

After a few months the supply from civilian sources of recruits with a reasonable degree of experience petered out, and it became necessary to introduce a new mustering to facilitate the recruiting of personnel considered fit for training. This mustering was known as "trainee nursing orderly". Applicants were chosen who displayed an interest in medical matters and held some recognised first-aid certificate. Evidence of their ability to benefit by further training was also required. Nursing orderlies and trainees were given the same course of training at Laverton. Intake increased until it reached the still inadequate figure of 25 a month.

When the R.A.A.F. Nursing Service was formed the duties of the male nursing orderlies were reduced in importance and responsibility, and in most cases became of much the same standard as those of a general hand. When Japan entered the war in December 1941 the male nursing orderly, who could serve in forward areas where women could not, came into his own again. It was evident, however, that the number of male orderlies available could never fill establishments in the greatly expanded R.A.A.F. which was envisaged, and in February 1942 it was decided to enlist sick-quarters attendants and nursing orderlies in the W.A.A.A.F.

A comprehensive scheme of training was prepared in which sick-quarters attendants after enlistment were given elementary training for three weeks at two or three selected medical units, followed by a period of duty in medical sections. A second phase of training was carried out at such medical sections, and this took three months, four or five lectures or demonstrations being given each week. After successfully completing an examination sick-quarters attendants were invited to apply for further training, the successful completion of which was regarded as the standard required for remuster to nursing orderly. This third phase of training was carried out at selected R.A.A.F. hospitals for a further period of three months. From this time onwards W.A.A.A.F. nursing orderlies began to replace males in most base units, except in isolated ones without a medical officer.

It was now possible to employ male orderlies in posts where they were most useful: in out-patients' departments, in male V.D. treatment centres, in psychiatric wards in base hospitals, and on strip duty at flying stations. Numbers went to operational posts in the United Kingdom, Middle East and South-West Pacific Area. They provided the only assistance available to medical officers in most field medical units, and were highly regarded by R.A.A.F. surgeons as operating-theatre attendants and nurses. They were found in charge of the medical sections of numerous radar stations and other small or isolated units, and with medical officers they formed the medical component of air-sea rescue flights.

In October 1943 the name of the male nursing orderlies' mustering was changed to "medical orderly", which was an advantage from the recruiting point of view as many applicants had previously objected to being called "nurses".

The general shortage of medical, or nursing, orderlies was thus reduced, but as the war went on the previous medical experience of recruits became progressively less until it was necessary to accept any applicant who was willing to be trained and who scored a reasonable percentage in the standard aptitude test. This meant that such personnel depended entirely on R.A.A.F. training for their medical knowledge. Medical training courses were carefully adjusted in the light of this development.

From February 1941 it became necessary to "screen" all clerical staff in medical units and sections, because of the possibility of losing clerks who had absorbed the complexities of medical terminology and the administrative details of medical forms and documents. It was not until 3rd January 1944, however, that two new musterings were introduced into the R.A.A.F. and the W.A.A.A.F.:

Group III Clerk Medical
Group IV Clerk Medical Assistant.

Remuster applications were invited from clerks working in medical sections, clerks-general remustering to clerks medical, and clerks to clerks medical assistant.

As the war progressed, clerical establishments increased at a rate which was far in excess of the increase in clerical strength, and it became necessary to secure a regular source of trainees. A certain percentage of trainees who had completed a two-weeks basic clerical course at a school of technical training were posted every three weeks to a medical training unit where a three-weeks course was provided, after which they were remustered to clerk medical assistant. The output rose to 30 every three weeks.

Trade test standards for remuster from clerk medical assistant to clerk medical were clarified in April 1945. Clerks medical were required to exhibit a detailed knowledge of orderly-room procedure, and reasonable proficiency as typists, in addition to the clerical knowledge laid down for clerks medical assistant.

At the outbreak of war there was no separate mustering for laboratory technicians, and the two technicians who were then in the R.A.A.F. were mustered as "nursing orderly". In order to provide some assistance to medical officers in the larger units it was necessary to give partial training to a few male nursing orderlies who had worked in laboratories in the navy before joining the R.A.A.F. and to some orderlies who had no previous experience but had studied chemistry and physics to the matriculation standard. This training was done locally at units with laboratory facilities.

With the expansion of the R.A.A.F. Medical Service after Japan's entry into the war, at least 35 trained technicians were needed, and a separate mustering was introduced. Laboratory technicians were enlisted direct from similar civilian occupations and some male medical orderlies were remustered after the necessary study and practical experience. Numbers fell short of requirements, however, and men with suitable educational background were posted to No. 2 R.A.A.F. Hospital for training under the supervision of the unit pathologist. Training took from two to four months according to the degree of previous experience, after which trainees were posted to a base unit for a further three months' experience. A posting then followed as technician to a medical clearing station. After completing a tropical tour, the technician was given a further six months' experience in a base hospital, followed by a second operational tour with a medical receiving station.

Before the war the R.A.A.F. had only one X-ray machine and two X-ray technicians who had qualified in their own time and were mustered as medical orderlies. When it was decided in April 1940 to carry out chest X-rays on all recruits on enlistment, more technicians were needed and the six top-ranking airmen in the first five electricians' training courses were given the opportunity to remuster to X-ray Technician (Group I) after suitable training. With the cooperation of the Melbourne Technical College these airmen were given a thorough and intensive course. This included elementary anatomy, physiology, and chemistry, with more emphasis on physics and X-ray technology, including the general run of production and application of X-rays, principles of subject and tube positioning, and care and maintenance of equipment. Practical experience was gained at various public radiological clinics. The usual two-years course was covered in four months of intensive study. All six trainees passed the recognised X-ray Technicians' examinations and were awarded the regular X-ray Technician's certificate.

For the first year of the war all medical administrative duties at R.A.A.F. Headquarters and formation headquarters, and in the R.A.A.F. hospitals were carried out by medical officers. When a shortage of medical officers developed, it was realised that much of this work could be done more economically by non-medical administrators and a few carefully selected Permanent Force nursing orderlies were granted commissions. Establishments were altered to allow them to be used instead of medical officers

for such posts as adjutants of hospitals and administrative assistants at R.A.A.F. Headquarters and on the staffs of the Principal Medical Officers.

The maximum establishment figures for orderlies, attendants, nurses and clerks during the war were: medical orderlies, 1,280; nursing orderlies, 380; sick-quarters attendants, 300; R.A.A.F. Nursing Service, 600; clerks medical, 434 (including 226 W.A.A.A.F.); clerks medical assistant, 249 (including 170 W.A.A.A.F.).

From the middle of 1940 roneoed "Medical Branch Technical Instructions" were circulated to all medical officers to inform them of various procedures and professional recommendations which the Medical Directorate wished to come into immediate use. Usually the subjects of the instructions were not suitable for publication in the standard Air Force Orders, ranging as they did from the treatment of meningococcal meningitis to the routines to be adopted in maintaining medical records; in any case, it was considered inappropriate to issue certain professional recommendations in the form of orders, and furthermore direct issue by the Medical Directorate avoided the delay which might have occurred between the initiating of an Air Force Order and its ultimate promulgation to all units. Later in the war the "Medical Branch Technical Instructions" were revised and printed in loose-leaf form suitable for keeping in a folder. Finally, Research Bulletins of Aviation Medicine were issued at regular intervals to medical officers throughout the Service to keep them informed of progress in this field.

The outline of a system of collecting and evaluating Service medical statistics had been sketched by a conference of officers of the three Services in 1940. The primary object of the system was to collect data for the medical history of the various Services during the period of the war and after. For various reasons—the delay in getting the scheme under way, the shortage of trained personnel, the failure to overtake arrears, and the incomplete nature of the collecting instruments or forms—the scheme as at first contemplated was abandoned by each of the Services and reserved as a post-war effort.

Few of the Service representatives at the 1940 conference seemed to be alive to the importance of collecting medical statistics or aware that branches of the Services other than the medical could obtain valuable information from them. There was also an imperfect understanding of the difference between what might be called planning and research statistics. The suggestion made by the representative of the Commonwealth Statistician that a plan should be instituted common to the three Services was not taken up, despite considerable support given to it at the time by Group Captain Daley.

After abandoning the 1940 scheme the R.A.A.F. fell back on the old, rather haphazard method which had been in operation for some years before the war. This method was probably satisfactory when the R.A.A.F. was small, compact and immobile, and when statistics were prepared only

once a year, but it was inadequate when the Service began to expand and to become highly mobile.

Data were required by both the Director of Organisation and the Director-General of Medical Services. The former required rates of temporary and permanent wastage and hospitalisation in Australia and in other parts of the South-West Pacific Area for ground staff, aircrew and W.A.A.A.F., and the latter a variety of data to measure the demand for medical services and for prediction and planning generally. These included admission and discharge rates, an analysis of disposal of discharges, rates of non-effectives and man-days lost, duration of treatment and so forth.

In 1943 Air Vice-Marshal Hurley introduced a system whereby a census of the sick was taken in every unit and medical establishment each week. For purposes of the census there were three types of unit: the first included the hospitals, medical receiving stations, medical clearing stations and medical rehabilitation units, the sole function of which was to treat the sick and wounded. Secondly there were the units, squadrons, and stations where there were sick-quarters and a medical officer, and where cases of minor sickness were retained and treated. Thirdly there were units which had no sick-quarters, although they might have a medical officer, and which were compelled to transfer their sick to another unit for treatment. The second and third types were subdivided for statistical purposes into "parent" and "dependent" units, a parent unit being one which gave medical attention to the personnel of another, dependent, unit.

Forms for the census were first issued in September 1943 and by the end of October reliable and accurate weekly returns were coming in from units in Australia. By December of that year the system had been extended to every unit. In January 1944 the collection was put on a fortnightly basis, and in November on a four-weekly basis. The last change, which was made because of the ever-present difficulty of obtaining clerks, particularly in the larger hospitals, was a retrograde one because out-of-date medical statistics were of very little administrative value, apart from their use for prediction purposes. It might have been avoided by the introduction of dual-purpose Hollerith cards, but this was not considered practicable.

In 1944 a special malaria return was instituted. A card was raised for every case diagnosed, and showed the usual identification data, the location of the patient's unit when he became a casualty, the probable area of infection, the type of malaria, whether a primary attack or a recurrence, and if the latter, the recurrence number, whether regular suppressive treatment had been given, the date and method of diagnosis, the name of the medical unit reporting, and the signature of the medical officer. The cards returned in each period for each area were summarised on a sheet which gave the incidence rates for first infection, first recurrence, other recurrences, and total cases. Information concerning the incidence and recurrences of malaria was thus made readily available from both clinical and operational-planning aspects.

CHAPTER 21

MEDICAL SUPPLIES

THE wartime medical supply organisation of the R.A.A.F. was not in satisfactory operation until the end of 1940, although large medical orders had been placed in the previous 12 months.

Since the formation of the R.A.A.F. in 1921 it had been the practice for the equipment officer in each unit, on the advice of the medical officer, to submit contract demands for the unit's anticipated requirements for the ensuing six months. These demands were sent to Air Force Headquarters, where they were considered by the D.D.M.S., who then sent them through the Directorate of Equipment to the Contract Board, Department of Supply, which called tenders and placed orders with various firms for delivery direct to the unit. Simple as this procedure appeared, in practice months sometimes elapsed between the raising of a demand and receipt of the goods. In the meantime, the medical officer who had asked for the supplies might have been moved on to another unit, and his successor, possibly a man with different methods and preferences, could find himself in possession of unwanted supplies.

The procedure continued with only slight modifications until the middle of 1940 when the system of medical supply was completely reorganised. The responsibility of calculating the medical equipment requirements for all units planned under the R.A.A.F. expansion program determined by the Directorate of Organisation was met by establishing a new staff appointment for a medical officer (MA2) at the Directorate of Medical Services. In August the commissioning of pharmaceutical chemists was decided on and six pharmaceutical officers were appointed. A long discussion on the official files indicates that the original intention was to appoint them at the larger units as dispensers, but in practice it was found that, apart from dispensing, much of their time was devoted to medical equipment (quartermaster) duties.

The rate of expansion of the Service at this time made the prediction of requirements a difficult problem. To meet it, MA2, Wing Commander S. F. Reid, and the Staff Officer, Pharmaceutical Service, Squadron Leader H. J. R. Gamble, produced an establishment for medical supplies similar to those existing for non-medical equipment. This tabulated the maximum entitlement of each item appropriate to the various types of medical units. These ranged from non-flying units of 250 men to the 200-bed hospitals. This establishment table formed the basis for unit provisioning and supply for the entire period of the war. Sometimes it was too rigidly applied. Drugs required outside this scale could be obtained by units only with the approval of the D.G.M.S. and, later, of the Principal Medical Officers.

It was not always possible to keep this establishment table amended to provide for changes in therapeutics and as a result of the approval

system delays in meeting unit requirements for new drugs occurred. In some cases approvals were withheld and serving medical officers and patients were denied drugs which were available in civilian practice. The need to use establishment tables for guidance only, to avoid their use in a restrictive way, and to apply the principle that the clinical need should always be met unless shortages of supply made this impossible, was demonstrated in this way.

In 1940 Nos. 1 and 2 Stores Depots were formed at Melbourne and Sydney respectively, and distributing points at Brisbane, and at Pearce, Western Australia. In the following year these distributing points became Nos. 3 and 4 Stores Depots respectively. There were as well a number of stores units in various locations. The stores depots were divided into groups. Each group held a particular range of equipment, and each was given an alphabetical designation; for example, aircraft spares were "A" group, motor transport "C" group and so on. The medical sections of stores depots were referred to as "R" groups, and they held supplies sufficient for three months.

The total establishment for pharmaceutical officers at the beginning of 1941 was 10 flying officers. In May 1941 the number was increased to 14, and the D.M.S. recommended that the establishments be varied to provide for one squadron leader at Air Force Headquarters, one flight lieutenant at each stores depot, and flying or pilot officers at the remaining stores units.

The medical supply organisation functioned smoothly throughout 1941 when the Empire Air Training Scheme was expanding rapidly, and many new units were being formed.

When Japan entered the war in December 1941 Australia was threatened with invasion. As defence activity was intensified in the north-eastern section of the continent and in the islands to the north, there were increasing demands for medical supplies and equipment from these areas. Stocks of supplies and equipment were laid down at Townsville and at Daly Waters, these holding points being the forerunners of No. 13 Stores Unit, which later became No. 11 Stores Depot, and of No. 9 Stores Depot respectively. No. 3 Stores Depot, Brisbane, issued medical stores to Port Moresby, the hospital ship *Manunda* being used to convey them. Frequently No. 3 Stores Depot had to pack and arrange the loading of large consignments at very short notice. At Port Moresby a medical store had been set up, and this should not be confused with No. 6 Stores and Shipping Unit, later called No. 16 Stores Unit, which was not established until January 1943.

Restriction of imports and enemy occupation of drug-producing countries led to shortages at a time when the demand was reaching a peak. Large orders, which were being placed on the drug trade by the three Services independently, caused embarrassment. The Medical Equipment Control Committee, set up in 1940 to advise the Government on the import, control, conservation and production of drugs and medical equipment, saw the need to coordinate the demands of the Services in the

interests of economy and of efficiency in planning imports and local production, and made a recommendation to that effect. This was strongly supported by the Department of Supply and Shipping and by the Business Board, and came into operation in December 1942. At intervals of six months, comprehensive stock reviews were carried out simultaneously by each Service, and requirements were assessed to meet the commitments of the next six months and to provide twelve months' reserve.

Contract demands were raised by each Service and passed to the Medical Equipment Control Committee, which considered the total requirements of the three Services against the quantities expected to be available. The demands then went to the Contract Board, Department of Supply and Shipping, where a catalogue, referred to as the "Combined Services Schedule", was drawn up, showing the individual and combined requirements of the Services, details of packaging and other specifications. This catalogue was forwarded by the Contract Board to all drug and medical equipment suppliers, and tenders were called. A conference was then arranged between the representatives of the Services, the Medical Equipment Control Committee, and the Contract Board to consider the tenders received. Where quantities available fell short of the total needs, it was often possible to transfer stocks from one Service to another. By this means close inter-Service liaison was achieved. Authority requisitions were finally issued by the Contract Board and orders were placed. This machinery made it possible to maintain a balance between the needs of the three Services and those of the civilian community.

The plan for the air defence of Australia provided for eleven stores depots, but it soon became apparent that the policy of purchasing supplies for delivery to eleven widely separated points would be both uneconomic and unwieldy. From March 1941 therefore reserves of essential items had been concentrated at Nos. 1 and 2 Stores Depots, and later at No. 1 Stores Depot Reserve Medical Store, Albury. This last-named unit was converted into a Base Medical Store in June 1942. It was commanded initially by Flight Lieutenant D. P. Felton, who was the first pharmaceutical officer to hold an independent command.

Early recognition of the necessity for a Base Medical Store contributed to the high standard maintained by the "R" groups of the stores-holding units. Unfortunately when space for the store at Albury was requisitioned the extent of expansion was not correctly predicted. Thus when additional floor space was required later it was not available, so that the unit became scattered.

In the stores units and air stores parks, which were smaller editions of the stores units, "R" groups were formed, each having a pharmaceutical officer and a small holding of stores. In the same way that an establishment table was used for units a similar publication was found necessary as a basis for distribution of stores from the Base Medical Store to stores depots. The annual turnover of Nos. 1 and 2 Stores Depots, related to the number of people served by those units, was used as the basis for this establishment table, allowances being made for losses in transit *et cetera.*

Until No. 1 Base Medical Store, Albury, became functional medical supplies for New Guinea were, as mentioned, mostly the responsibility of No. 3 Stores Depot—a heavy burden. On one occasion as a substitute for unavailable *tulle gras* Brisbane's whole supply of mosquito netting had to be purchased to fill the considerable demand from New Guinea arising from its use for treatment of burns. This period also provided an example of the kind of difficulty that might arise as a result of the misuse of establishment scales. One store in New Guinea made repeated requests for cocaine alkaloid and other items for which the clinical demands were negligible. Inquiry revealed that these requests were merely transcriptions of the quantities on the establishment table and bore no relationship to actual needs or to stocks held.

As the war progressed the number of holding points for medical equipment rose from the original two stores depots to: one base medical store, seven stores depots, one stores unit and nine air stores parks. The number of pharmaceutical officers increased from one squadron leader, 3 flight lieutenants and 10 pilot or flying officers to 4 squadron leaders, 21 flight lieutenants and 32 flying or pilot officers. The pharmaceutical officer proved a most important member of the Service by reason of his contribution both on the medical and the supply side.

CHAPTER 22

MEDICAL UNITS IN BASE AREAS AND IN THE FIELD

THE R.A.A.F. administration at the outbreak of war consisted of one headquarters, which controlled all the stations in the Commonwealth. As the air force expanded command had to be delegated, and this was done in the first place by the establishment of area headquarters, each of which administered the units within its geographical boundaries. The original headquarters were: Southern Area (Victoria, South Australia and Tasmania), Central Area (New South Wales and southern Queensland), Northern Area (northern Queensland, Northern Territory, Papua and New Guinea) and Western Area (Western Australia). A medical officer, who was called the Principal Medical Officer, was appointed to the staff of the air officer commanding each area, and as the P.M.O's duties gradually became heavier, a Deputy Principal Medical Officer and an Assistant Principal Medical Officer were added to the area headquarters establishments to assist him. The Assistant Principal Medical Officer also acted as a *locum tenens* at isolated stations, where it had previously been difficult to arrange leave for the medical officers. Later, as the war developed in tropical areas, each of the Principal Medical Officers was given the assistance of a qualified hygiene inspector, who was called the Area Hygiene Officer.

In August 1941 it was decided to establish headquarters on a functional rather than a geographical basis. In Victoria, Tasmania and South Australia No. 1 Training Group became responsible for training and Southern Area for operations. In New South Wales and southern Queensland No. 2 Training Group, and Northern Area had equivalent responsibilities. Central Area ceased to exist and its units were allotted to the neighbouring areas. In Western Australia, Western Area remained unchanged as a combined headquarters for training, operations and maintenance and supply. It was thought that in the event of warfare on the mainland this arrangement would afford greater freedom of action.

As these new headquarters in Victoria and New South Wales were likely to be scattered, it was decided to appoint a P.M.O. to each. Static units, such as base hospitals and rehabilitation units, remained under the control of the training groups, and operational units, medical receiving stations and the like, under the control of the operational headquarters.

In practice the multiplicity of headquarters in Melbourne and Sydney was found to be inconvenient as well as wasteful of medical manpower. The R.A.F. during the campaigns in North Africa and Europe had developed the policy of one medical authority in each geographical area, and Air Vice-Marshal Hurley decided that the medical affairs of each geographical area of the R.A.A.F. would also be administered more efficiently by a local medical authority. The Principal Medical Officers of Nos. 1 and 2 Training Groups then became the senior Principal Medical

Officers in Melbourne and Sydney respectively, and were responsible for such matters as medical boards, specialist appointments, hospitalisation *et cetera*: the other Principal Medical Officers merely acted as advisers to their Air Officer Commanding on matters concerning the units in their respective commands. In April 1945 the Principal Medical Officers of Nos. 1 and 2 Training Groups respectively took over all P.M.O. functions for Victoria, Tasmania and South Australia in the one case, and for New South Wales and southern Queensland in the other.

When Japanese forces invaded the islands to the north of Australia, Darwin, New Guinea and northern Queensland were all under the command of the Northern Area headquarters, situated at Townsville. On 15th January 1942 Northern Area was disbanded, and a new headquarters, North-Eastern Area, assumed control of north Queensland, including Horn Island, while the Northern Territory was placed under another new command, North-Western Area. The direction of operations in New Guinea later passed to a third new formation, No. 9 (Operational) Group, and when a further area of operations was opened in northern New Guinea in November 1943 No. 10 (Operational) Group was formed to control it. These groups for a time each administered a medical receiving station, a malaria control unit and a medical air evacuation and transport unit; and a Principal Medical Officer and subordinate medical officers, such as a D.P.M.O. (Hygiene) and a Group Hygiene Officer were included on their staffs.

No. 9 (Operational) Group became the new Northern Command in April 1944 and No. 10 (Operational) Group became First Tactical Air Force in October. Late in the same year the orthodox air force delegation of administrative authority was reintroduced, this time through a structure of a number of wing headquarters, each of which administered three squadrons, a repair and salvage unit and a medical clearing station. Medical administration had now assumed the form which had been desired by the Directorate of Medical Services from the early stages of the New Guinea campaign.

Hospitals. Before the outbreak and during the first months of the war R.A.A.F. establishments had comprised headquarters and six permanent stations: Laverton (Victoria), Richmond (New South Wales), Pearce (Western Australia), Amberley (Queensland), Darwin (Northern Territory) and Port Moresby (Papua). The men on these stations were housed in standard service hutments, and fed in well-built permanent messes with kitchens attached; the areas were in most cases sewered, and those that were not had other satisfactory sanitary arrangements.

The stations' medical sections consisted of sick-quarters with facilities for emergency surgery, the medical officer's consulting room, a dressing room and staff quarters. Shortly after the outbreak of war plans were drawn up by the Directorate of Works and Buildings for standard sick-quarters for stations of 500-men strength and multiples of this. Priority in the provision of buildings and equipment had to be determined by the

extent of flying effort on the various stations, and at first those on which not much flying was done were inadequately equipped from the medical point of view. Patients with minor ailments were treated in the station sick-quarters, while those requiring hospitalisation or specialist opinion were referred to the Repatriation Commission's institutions.

After April 1940 when the Empire Air Training Scheme was initiated, numbers of new stations were set up throughout Australia. As the number of men at each of these stations varied from 250 to 2,000, it was impracticable to bring all who required hospital treatment to the Repatriation hospitals in the capital cities, and equally impracticable to provide for hospital treatment at all the stations. Therefore, where there was a well-equipped civil hospital near a unit, the air force made arrangements for it to take serious cases at an agreed daily rate of payment, and for experienced local general practitioners to treat these patients. These practitioners were appointed to the R.A.A.F. Reserve, and were assisted as far as possible in the treatment of air force patients by the local R.A.A.F. unit medical officer. Cases requiring more protracted treatment were taken to the capital cities.

As the numbers of men in the air force continued to increase during 1940 these arrangements for the hospitalisation of the seriously ill were seen to be inadequate. The army had already planned large base hospitals in each capital city, but these were not yet available. While the army was able to take care of its own cases for the time being by using field general hospitals which were in training before going overseas, the navy and air force could not hope that the Repatriation hospitals would be able to cope with all their seriously ill men.

Air Vice-Marshal Hurley met air force needs temporarily by arranging for the conversion into 200-bed hospitals of the sick-quarters at Laverton, at the Engineering School at Ascot Vale, Victoria, and at Richmond, New South Wales. These, which were called Nos. 1, 2 and 3 R.A.A.F. Hospitals respectively, were the first independent medical units to be formed in the R.A.A.F., and careful attention was given to the production of their standing orders. Wing Commanders P. J. Benjamin, P. R. Delamothe and D. S. Thomson were selected as their commanding officers. Existing brick structures at the three stations were converted to provide operating theatres, X-ray and pathology departments and dispensary, and wards were set up in temporary huts built round the central structure. Temporary hospital facilities were secured in other cities by extending the sick-quarters of one of the local stations.

No. 2 Hospital was the only hospital which the R.A.A.F. had in southern Victoria to accommodate patients with notifiable infectious diseases including venereal disease. It also admitted some infectious disease cases from the army and navy, as well as men with minor ailments from all R.A.A.F. units in and around Melbourne which had no sick-quarters of their own. During the winter of 1942 it continually had more patients than regular beds, and emergency accommodation had to be provided near by for the overflow.

This hospital was very unsatisfactory in several ways. It had no suitable accommodation for W.A.A.A.F. personnel suffering from infectious diseases; the out-patients' department, which was extremely busy, was quite inadequate; it was extremely difficult to feed the large number of patients within the hospital, all food having to be carried hundreds of yards from the general airmen's mess, and the medical stores had to be distributed over a large number of buildings quite unsuited for the purpose. Although minor works were carried out from time to time to provide internal bathrooms, pan rooms, stores and heating stoves, the lack of adequate services and the overcrowding caused a high degree of discomfort to the patients, and increased the danger of airborne cross-infection. The conditions also imposed a heavy burden on the staff.

The position eased as soon as accommodation became available to the R.A.A.F. at No. 115 (Heidelberg) Hospital. Even so, Air Vice-Marshal Hurley considered that conditions would have to be improved at No. 2 R.A.A.F. Hospital, and a detailed works program was submitted to the Air Board in November 1942. It provided for a new 48-bed ward for members of the W.A.A.A.F. suffering from infectious diseases, accommodation for 40 more nurses, a suitable kitchen, a new out-patients' department, a central medical bulk store, additional space for hospital administration and minor alterations and additions to existing wards. This plan was approved, but the work progressed only slowly, and was not completed until July 1943.

When Japan entered the war in December 1941 the large operational stations were considered potential targets, and it had seemed desirable to remove hospitals from their vicinity. Hence No. 1 R.A.A.F. Hospital had been moved from Laverton to Wagga Wagga, New South Wales, and No. 3 R.A.A.F. Hospital from Richmond to Bradfield Park, New South Wales.

The new hospitals such as that at Heidelberg were to be administered by the army, but it was agreed by the Committee of Service Medical Directors that separate wards or parts of wards would be set aside for patients from the navy and air force, and those Services would be at liberty to supply their own medical and nursing staff and any necessary clerical staff. Part-time specialists of the R.A.A.F. would be available for consultation with R.A.A.F. medical officers, and army and R.A.A.F specialists would see patients belonging to either Service when necessary. In this way economy would be achieved in the use of specialists.

It was finally decided that it would be impracticable to allot a definite proportion of beds in any hospital to the navy and air force, but the Director-General of Army Medical Services undertook that separate wards would be set aside for their patients. This would not be an immutable arrangement, and allocations would depend on requirements from time to time, unoccupied beds in any ward being regarded as available, at the discretion of the commanding officer, for patients of any of the three Services.

By January 1942 the D.G.M.S. (Army) had agreed to make the following accommodation available to the R.A.A.F. in army hospitals:

(*a*) *Melbourne* (*Heidelberg*)
Three 34-bed wards were allotted to the R.A.A.F., the army providing equipment and the R.A.A.F. staff.

(*b*) *Sydney* (*Concord*)
Four 34-bed wards were allotted to the R.A.A.F. under the same conditions.

(*c*) *Perth* (*Hollywood*)
The R.A.A.F. had not sufficient cases to occupy one whole ward. It was arranged that R.A.A.F. patients would occupy a portion of one ward and that the R.A.A.F. would provide a proportion of the staff.

(*d*) *Brisbane* (*Gleenslopes*)
R.A.A.F. patients were to be admitted on the same basis as at Hollywood.

The army hospital at Springbank, Adelaide, had not been completed up to this time, and in April 1942 arrangements were made with the army for R.A.A.F. patients to occupy wards at the Morris Hospital, the parent unit in this case being No. 4 School of Technical Training.

When the total number of beds occupied by the R.A.A.F. at Heidelberg and Concord was sufficiently large, separate R.A.A.F. hospital units were established there. The R.A.A.F. then administered its own wards as lodger units inside the army hospitals. In the other capital cities none of the air force sections at the army hospitals ever became large enough to justify this action. In Adelaide, however, the station sick-quarters of No. 4 School of Technical Training expanded, and was established as No. 7 R.A.A.F. Hospital.

There was frequent criticism of the number of staff employed in air force as compared with army wards. This criticism culminated in an official letter from the Adjutant-General to the Air Member for Personnel complaining of the "luxurious use of medical personnel in air force wards, compared with army wards". This was referred to Hurley, who replied to the D.G.M.S. (Army) at some length, refuting the complaint with facts and figures and concluding:

> the fullest cooperation is vitally necessary between the Services, and it is most undesirable, in my opinion, for any of the Services to criticise or draw comparisons with a sister Service without a full knowledge of the facts. In medical matters the machinery exists for the fullest discussion between those competent to know either in the Central Medical Coordination Committee or in the Committee of Service Medical Directors, at any rate before involving other non-medical branches of the Services.

In June 1942 the provision of R.A.A.F. hospital accommodation was reviewed. The suggested basis was 6 per cent of operational personnel and 4 per cent of personnel under training and training staffs on the mainland of Australia. In the case of operational personnel, provision was to be made on the basis of 2 per cent in sick-quarters with the units and 4 per cent in hospitals: for training personnel on the mainland the basis would be 2 per cent in sick-quarters and 2 per cent in hospitals. It was assumed that about half the force would be employed under operational conditions and half under training conditions. In early 1943 the

estimated total force, not including about 20,000 men in Europe, was 120,000. Total requirements would thus be 3,600 hospital beds, and 2,400 sick-quarters beds. At this time the air force had only 1,090 hospital beds in the army hospitals and the R.A.A.F. hospitals, including the medical receiving stations, whose establishment is described later. Allowing for 600 additional beds which the force expected to obtain in the army hospitals, it was still faced with a deficiency of 1,910 hospital beds.

As the army stated that it would be unable to make a larger allotment in its hospitals, it was recommended by the Service medical directors that authority should be granted to the R.A.A.F. to build base hospitals of its own in Melbourne, Sydney and Brisbane, with a capacity of 200 beds each in Melbourne and Sydney, and 100 in Brisbane, the hospitals to be planned so as to be capable of expansion. Slightly smaller hospitals were to be established at Wagga Wagga and Corowa, New South Wales, and at Sale, Victoria. Soon afterwards the Department of the Army undertook to make a further 204 beds available immediately to the R.A.A.F. in its hospitals in the capital cities, and a further 460 beds by September 1943. After considerable inter-departmental discussion it was decided to abandon the proposal to build R.A.A.F. base hospitals in the capital cities, but to continue with the projects in country areas. As a result, new R.A.A.F. hospitals were built at Sale, Victoria, and Wagga Wagga, and, in place of the proposed hospital at Corowa, a hospital at Tocumwal, New South Wales, was taken over from the Americans, and became No. 5 R.A.A.F. Hospital. The provision for the R.A.A.F. in the army hospitals was gradually increased, and by early 1944 the beds occupied by the R.A.A.F. in these hospitals were:

Brisbane . . .	80 beds
Sydney	350 beds
Melbourne . . .	400 beds
Adelaide . . .	110 beds
Perth	45 beds

The army now agreed that additional provision would be made to the extent of 100 beds in Brisbane, 250 in Sydney, 100 in Melbourne, and 100 in a new hospital to be built in Townsville.

On 21st January 1944 the War Cabinet directed "that the total existing army hospital accommodation, both Australian and American, be surveyed and that such accommodation be allocated to each of the Services in such a manner that the most effective use is made of the available accommodation for the future prospective requirements before any additional hospital accommodation is erected".

The War Cabinet further instructed that the proposed survey be extended to include navy and air force hospital accommodation, and that it be undertaken by a committee representative of the three Service departments and the United States forces with an independent chairman to be appointed by the Minister for Defence. Mr C. L. McVilly of the Victorian States Charities Board was appointed chairman and two representatives were nominated from each of the Services. For the information

of the committee R.A.A.F. hospital accommodation was again reviewed in the light of existing and prospective commitments. The same basis of estimation of requirements was used as in the review of June 1942. The estimates, based on an anticipated total of about 170,000 R.A.A.F. personnel in the South-West Pacific Area, including Australia, showed that the total number of beds required, including those in sick-quarters, was approximately 8,000.

The air force had at the time about 5,000 beds, equally divided between sick-quarters and hospitals, base and field. Excluding the sick-quarters, which would be provided in any case, there was an estimated deficiency of 2,000 hospital beds, but it was thought that if the then low sickness rate continued, requirements would probably be met by 1,000 additional beds, to be distributed as follows:

Northern Queensland	200
Southern Queensland	200
New South Wales	250
Victoria	150
South Australia	100
Western Australia	100

These estimates were duly considered by the survey committee, whose report was submitted to the War Cabinet by the Minister for Defence on 21st August 1944. It recommended that the additional needs of the R.A.A.F. should be met by an increased allotment in the army hospitals in the capital cities and in Townsville.

When the war ended in August 1945 the R.A.A.F. had a total of about 6,500 beds, including those in sick-quarters. Its occupancy of beds in the army hospitals was approximately:

Sydney	over 500
Melbourne	over 400
Perth	100
Brisbane	150
Adelaide	100

Medical Sections. All squadrons and all support units in the field had medical sections with fully mobile equipment, including tented sick-quarters for about 2 per cent of their strength. These sick-quarters retained and treated only the minor sick and wounded; severe casualties were normally retained only until resuscitated sufficiently to be evacuated, infusion panniers and serum being supplied for the purpose. The squadron medical panniers contained a full set of surgical instruments, but they were intended to be used only when a squadron was separated from its wing and evacuation was not possible or would endanger the life of the patient.

Medical Clearing Stations. Each wing in the field was allotted a medical clearing station for hospitalisation of men requiring bed treatment for a short period only. The bed establishment was 40, and patients were not held in excess of this number, except in an emergency when as many

as 100 could be held. Normally, if an overflow threatened it was averted by evacuating a sufficient number of patients to a medical receiving station (M.R.S.). The M.C.S. also evacuated to an M.R.S. all who would require treatment for longer than 10 days or prolonged or specialist investigation. With typhus patients an exception was sometimes made where the line of communication was long, or evacuation liable to worsen the prognosis. Uncomplicated cases of malaria and dysentery were also treated in medical clearing stations, even if the standard course of treatment exceeded 10 days. Surgery of election was not performed, men requiring such surgery being evacuated to an M.R.S. if their condition interfered with their duty or was progressive or liable to endanger their health. In the event of a move all men were evacuated who were unfit to return to duty.

The staff consisted of two medical officers, an adjutant, who also acted as dispenser and quartermaster, and 27 other ranks; no sisters were included. The established tentage was one Australian-type hospital marquee (40 beds), 2 American hospital tents (20 beds each), 2 Australian stores marquees, and 13 Australian tents, 14 feet by 12. The hospital marquee, which was 80 feet long and 20 feet wide, was easily assembled. The operating theatre consisted of a prefabricated hut, which could be erected in a few hours. The X-ray plant was a Watson Victor SF1, and a small dark room was improvised. The pathological equipment included a mobile incubator, microscopes, stands and other necessary items. The hospital beds were in the main special Jarco-type stretchers with a single-piece wooden frame, curved on the ends with folding legs, but iron bedsteads were used for nursing seriously ill patients. Electric fans were also provided, and these were invaluable in minimising the effects of the hot, humid weather on the critically ill, especially those with severe burns. Medical supplies for three months were held. The kitchen had two small American oil-burning stoves or two Fowler stoves, and fly-proofing was improvised at each location. Refrigeration consisted of four kerosene refrigerators, each with a capacity of 5½ cubic feet. This was found to be a minimum requirement for a hospital of this size in New Guinea.

Motor transport comprised three jeeps and trailers, one water carrier and one mobile 5 KVA generating unit. All the equipment of an M.C.S. was compact, and designed for transport by air, 16 Dakota loads serving to move a whole unit.

Medical Receiving Stations. In the early days of 1942 when a Japanese invasion of the mainland seemed possible it became necessary to provide field hospitals of some kind not only in the Northern Territory and Queensland but also in the south. The R.A.A.F. field hospitals which were set up then were similar in size and establishment to the R.A.F. field hospitals, and like them were known as medical receiving stations. The establishment was 100 beds, and in an emergency could be expanded to 200 beds. The staff consisted of 12 officers, including 8 sisters, and 67 other ranks; the commanding officer held the rank of wing commander and a surgeon specialist and a physician specialist the rank of squadron leader. The medical receiving stations provided for the total hospital needs

of the R.A.A.F. in the field, and thus performed the functions of an army casualty clearing station and general hospital combined.

In May 1942 No. 1 M.R.S. was formed at Daly Waters, Northern Territory, No. 2 at Clydesdale near Richmond, New South Wales, No. 3 at Townsville, Queensland, No. 4 at Pearce, Western Australia and No. 5 at Werribee, Victoria.

As it was considered at the time that these units would need to be completely mobile, all accommodation was in tents. The only tentage for wards then available consisted of large locally-made marquees without flies, and although not particularly satisfactory, they served their purpose until more suitable hospital tents became available.

Stretchers similar to those in medical clearing stations were used, supplemented by twelve hospital bedsteads for the seriously ill. Refrigeration was supplied by a 50-cubic foot motor-driven refrigerator for the kitchen and eight 5½-cubic foot kerosene refrigerators for the wards. All cooking was done in mobile Wiles steam cookers, which were of Australian design and widely used throughout the Service.

As the threat to Australia decreased the medical receiving stations were not required in the southern States, and were transferred to New Guinea. No. 3 M.R.S. moved to Port Moresby on 3rd October 1942, and was replaced at Townsville by No. 2 M.R.S., which had moved up from Clydesdale. On 10th December No. 5 M.R.S., which had come up from Werribee, took over from No. 2 M.R.S. at Townsville, and No. 2 M.R.S. moved to Milne Bay. No. 5 M.R.S. later moved to Goodenough Island. No. 4 M.R.S. never functioned to capacity owing to the lack of air activity in Western Australia. However, it was maintained there for a time for strategic reasons. Later it was transferred to the north-west coast to care for the advanced flights of heavy bombers which were operating against Timor and the Netherlands East Indies.

When these units moved out of Australia to New Guinea it was no longer so important for them to be highly mobile. Therefore, as tents became unserviceable they were replaced by native-type huts or prefabricated huts with galvanised iron roofs. These were quite suitable for the climate.

The medical receiving stations accepted and treated all men evacuated to them from the wings of their formations by the medical clearing stations. Normally, they retained all who could be expected to return to operational duty within three months, although this period could be varied by the D.G.M.S.

When a patient's tour of tropical duty was due to expire before the anticipated date of his fitness for duty, he could be evacuated to a base hospital, irrespective of the three months' limit. Medical receiving stations normally evacuated to base hospitals only those men

(*a*) whose treatment was expected to take longer than three months, or who were considered to be permanently unfit for tropical or operational service;
(*b*) for whose treatment facilities did not exist in the M.R.S. or army hospitals in the area;

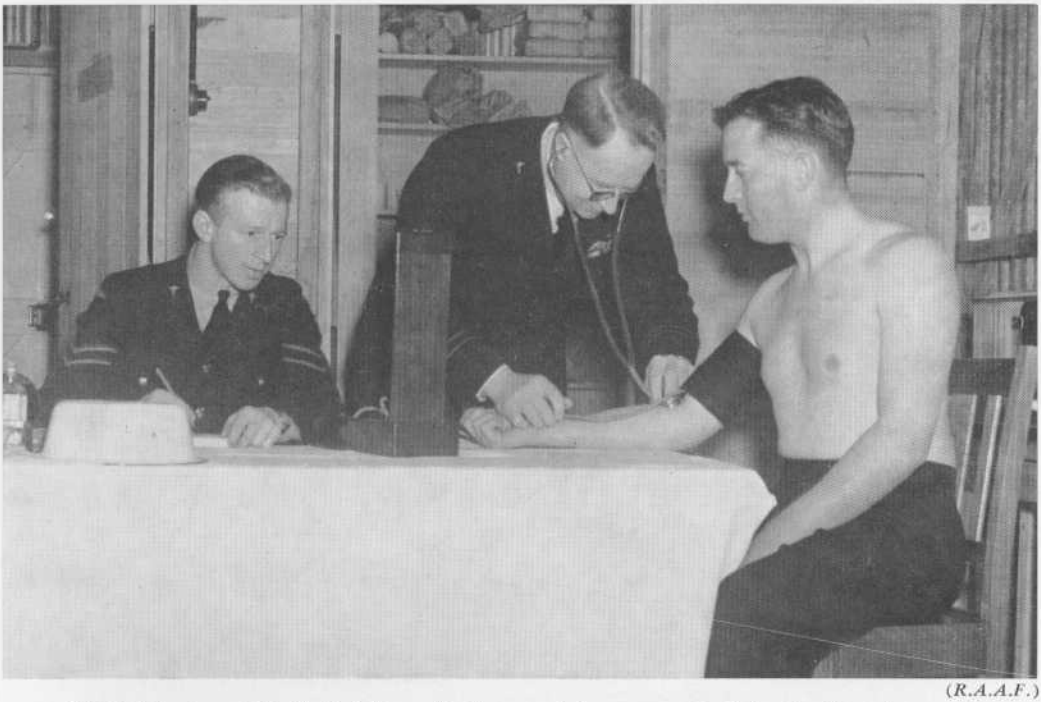
(*c*) whose evacuation was necessary to clear sufficient beds to receive cases from the M.C.S's;
(*d*) who suffered from conditions which were reasonably certain to recur if they were retained in tropical areas after recovery—for example, certain skin conditions;
(*e*) who were suffering from malaria and who had had blackwater fever, or who had post-malarial anaemia, or such conditions as a chronically enlarged spleen; and
(*f*) who had post-typhus debility.

Operations of election involving joint cavities were not performed in medical receiving stations. Men requiring such operations were evacuated to base hospital if unfit for duty or if their condition was progressive.

Evacuation of Casualties. The commanding officer of the medical unit concerned was the authority for the evacuation of individual cases. The P.M.O. was responsible for ensuring that the general principles for evacuation were observed. He might at any time order the evacuation of all or part of the cases in an M.C.S. or M.R.S. if this became necessary for tactical reasons.

Throughout the New Guinea campaigns the evacuation of casualties to base hospitals at the capital cities was carried out almost entirely by air. The visits of hospital ships were infrequent, and when they did occur were usually to ports near large army hospitals, which were as a rule remote from medical receiving stations. This was due to the fact that until early in 1945 the R.A.A.F. was often operating in direct support of United States forces in areas where there were then no, or few, Australian troops, such as Milne Bay, Goodenough Island, Kiriwina, Aitape, Hollandia, Biak and Noemfoor. Evacuation by air was the function of the medical air evacuation transport units, which arranged the supply of aircraft and medical escorts for casualties of all Services from forward areas. Evacuation was carried out in ordinary transport aircraft, supplemented by special air ambulances, which were available for off-schedule routes or for evacuations which could not be arranged in ordinary transport aircraft. The work of the medical air evacuation transport units is described in detail in a later chapter.

Squadron Medical Officers. It will be readily appreciated that one of the most important medical appointments in the air force was that of squadron medical officer. The principal responsibility of these officers was the physical and mental care of aircrew, both individually and collectively. Much time and money had been spent on the training of aircrew; they controlled valuable aircraft and, although their numbers were relatively small, they were in fact the basic reason for the existence of the whole complex structure of the air force, and in their operational effectiveness all activities of that Service culminated. Widespread failure at this point would mean that achievements at all other Service levels were null and void; it would mean that the Service as a whole had failed. Thus it could be said that the squadron medical officer's role was a key one in the medical service, a fact deserving rather more recognition than it obtained in some medical and other circles at the time.



(*R.A.A.F.*)

Flight Lieutenant V. E. Knight medically examining a recruit, John C. Canterbury, at No. 2 Recruiting Centre. Canterbury, who was on No. 1 E.F.T.S. course, was killed later in a flying accident



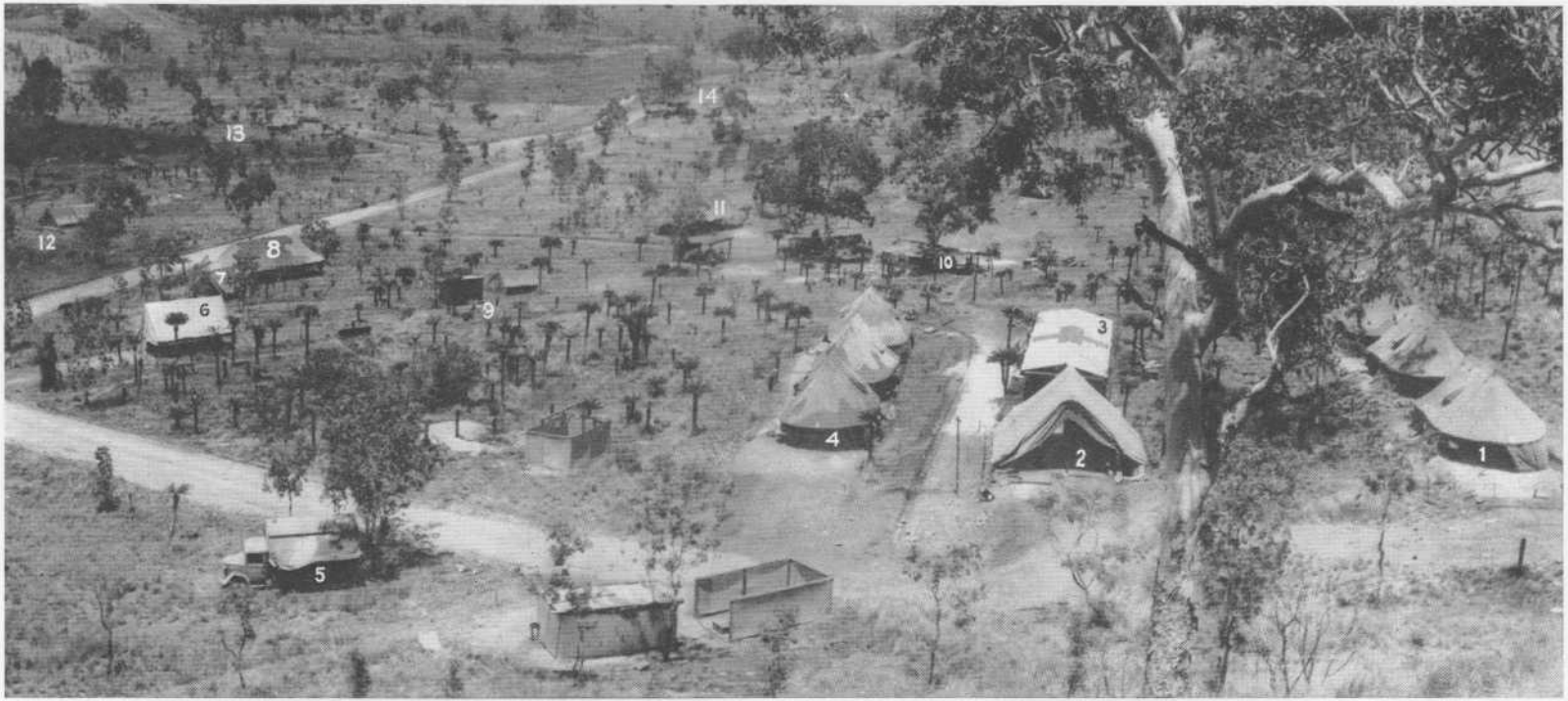
(*R.A.A.F.*)

Medical Training Unit, "Larundel". A display of medical and surgical panniers and survival and other kits. The contents of a surgical pannier are displayed in the foreground.



(*R.A.A.F.*)

Medical section of No. 17 Stores Unit R.A.A.F. at Milne Bay, July 1943.



(E. A. Daley)

No. 3 Medical Receiving Station, Port Moresby, November 1942, showing (1) surgical wards; (2) X-ray; (3) operating theatre; (4) medical wards; (5) power tender; (6) admitting and outpatients; (7) pathology; (8) dispensary; (9) canteen; (10) kitchen; (11) airmen's mess; (12) orderly room; (13) barracks store; (14) transport.



No. 1 R.A.A.F. Hospital, Wagga, New South Wales, 5th October 1944. *(R.A.A.F.)*

In looking to the welfare of aircrew as individuals the squadron medical officer had in mind at the same time the medical maintenance of the squadron as a whole and preservation of its optimum effective strength. In addition to his primary responsibility, his duties embraced conduct of sick parades, treatment of all casualties, evacuation of non-effectives and attention to the many details of sanitation and hygiene which were part of the life of a service doctor in the field.

Special personal qualities were required in a squadron medical officer. Ideally he was selected early in his medical career when he was adaptable to squadron environment, and able to withstand the physical strain of active service conditions. Some squadron medical officers learned to fly. The remainder learned as much as they could about flying, about the aircraft of the squadron—range, fire power, ceiling, manoeuvrability, bomb-load, cruising speed—and about aircraft recognition, tactics, Intelligence and the like. This enabled them to "talk shop" in the mess, and so to be accepted by the aircrew as an integral part of the squadron.

Popularity in the mess was a factor in the selection of a squadron medical officer. Aircrew members who would not attend sick parades officially might approach the medical officer there. The mess was designed for relaxation, and it was not in general desirable to use it for "bar consultations"; however, if the mess was the only place where men would ask for advice, the medical officer would give it to them there. Aircrew members might also talk about themselves in the mess, about their pre-Service environment, medical history and training experience, previous operational tours, flying accidents they may have had, and also perhaps about their financial or domestic worries. The medical officer in possession of such information would know if any man was suffering from an unusual strain, and he could take steps to see that this did not reach the stage of decompensation.

One of the duties of the squadron medical officer was to give instruction to aircrew on tropical hygiene and first aid. First aid was of particular importance to bomber and reconnaissance crews, as there was often a long interval between a plane being hit and its return to base. The medical officer could impart such instruction informally in the mess or in the stand-by hut when the men were filling in time, as well as during official lectures.

The medical officer also took part in the leisure activities of aircrew whenever possible. It was important that these activities should contribute to, or at least not interfere with, flying fitness. Sport helped to maintain fitness. While most crew members enjoyed sport, they were not disposed to do the necessary organising. The medical officer could do this for them, and he could also arrange other entertainments which might help to dispel boredom, a contributing factor to tropical and operational fatigue. An excess of alcohol was detrimental to flying and to health generally but moderate amounts induced relaxation and produced an emotional outlet which was of benefit, particularly in forward areas. The

medical officer by setting an example of moderation could discourage over-indulgence by other members of the mess.

High motivation, voluntary enlistment, the selection procedures used at recruiting centres and the testing periods of service at flying training and operational training units were factors which helped to exclude from operational aircrew men who were likely to break down mentally. Nevertheless, as already mentioned, the successful squadron medical officer was constantly on the alert to detect signs of mental strain in its early stages and to avert an actual breakdown by taking appropriate action. Developing chronic strain sometimes manifested itself through such signs as over-alertness or hyper-activity, over-confidence, under-confidence, irritability or quick temper. A common symptom was that of physical and mental fatigue too easily induced, and in such cases increased smoking and drinking often provided pointers to the condition. At other times there would be no detectable early signs, and an emotional crisis would be the first indication of the disorder. Another pattern of manifestation was the train of psycho-neurotic symptoms of anorexia, headache, palpitations and insomnia.

Apart from organic disease, the main causes of mental breakdown in aircrews fell into two loosely defined and overlapping categories.

(1) The response to repeated exposure to danger either of enemy action or of flying hazards, such as weather, blind flying, aircraft accidents, motor trouble, *etc.*

(2) Cumulative flying fatigue.

Open discussion of the mental strain of flying generally and of combat flying in particular was desirable. The tendency was to regard the natural responses to danger, anger and fear, as shameful, and the medical officer had to dispel this deep-rooted idea as quickly as possible. Some aircrew members who finally paraded to the medical section on the grounds of mental strain had reached an advanced stage, and treatment was prolonged and difficult, whereas in the early stages all that might have been necessary was an opportunity to discuss and rationalise their worries.

Cumulative flying fatigue and its prevention and early recognition made up an important part of the work of a medical officer in any flying unit, whether operational or non-operational. A subjective state of tiredness, accompanied by some degree of reduction of efficiency, which for lack of a better term is known as fatigue, is the natural physiological consequence of a day's flying or other activity; it is normally dissipated by a good night's sleep. If, however, a condition develops wherein a substantially complete reversal of this state does not occur overnight, a cumulative factor is introduced; the progressive condition now borders on a pathological rather than a physiological one. Early recognition and treatment of this condition resulted in a quick return to full duty, but if the condition was overlooked for a longer time, recovery was disproportionately slow. Various attempts were made to devise an acceptable formula for limiting the duration of an operational tour and thereby preventing fatigue. The number of flying hours, depending on the type of aircraft, the number

and type of missions or sorties, and the length of service in a given area, provided a basis for generalisation only. Other factors to be considered were climatic conditions, the standard of living quarters and nutrition, the regularity or otherwise of hours of duty, and in some areas boredom and monotony, particularly in fighter squadrons where aircrew were on stand-by for long periods without action. Cockpit defects such as vibration, glare, cold, exhaust fumes, cramped postures and poor cockpit layout had to be considered when much flying was done, while the possibility of enemy attack either on the ground or from the air was, when present, an additional factor. It was desirable for this and other reasons to establish a camp at a reasonable distance from the airfield and other target areas.

The medical officer had to ensure that the rest periods of aircrew were optimally spaced, and an operational tour was terminated before efficiency deteriorated significantly. For the shorter rest periods aircrew were sent, if possible, to a place well away from the atmosphere of flying and operations where they could relax and be comfortable with access to various diversions. When an individual's tour of operations was approaching its end the actual date of termination was never made known, as there would have been a strong tendency on the part of some aircrew members towards over-caution, with consequent loss of operational effectiveness. There was also the possibility of postponement and, if the date had been announced, disappointment could have had a harmful effect on morale.

Sometimes all precautions were in vain, and an aircrew member would state that he was unable to carry on with his flying duties. The squadron medical officer, though relatively inexperienced from a professional point of view, would then be required to make a decision which, if ill-judged, could jeopardise the safety of a valuable aircraft and crew and perhaps of other members of the squadron. He had to decide whether that particular crew member was fit to fly or not. In frankly clinical cases, of course, there was no problem: the airman was grounded and returned to flying if and when fit. The difficult case was the one which showed symptoms out of all proportion to the organic findings, which frequently were negative or quite trivial. The question then arose whether there was wilful exaggeration or whether a functional state existed which warranted medical as opposed to administrative disciplinary consideration. On some occasions there would be time for deliberation; at others a decision might be required a few minutes before take-off for a particular sortie.

Three courses were open to the medical officer. The first was to have the crew member grounded and evacuated through medical channels for further investigation or treatment. This would cause a temporary deficiency in the squadron strength while a replacement was arranged. If the crew member had consciously used a trivial ailment as an avenue of escape other members of the crew probably knew about it; to see a man "get away with it" was dangerous to the morale of others who had been under similar strain, yet continued to fulfil their obligations with courage and

devotion. The medical officer therefore had to be sure that the case was genuine. If he decided that it was, evacuation was carried out promptly and quietly. A man who "cracked up" was treated as infectious, and likely to have an adverse influence on other crew members who might be on the borderline of breakdown. Alternatively, the medical officer, if he suspected a crew member of weakening, might persuade him to carry on either by reassurance and encouragement, or if this failed by pointing out the unpleasant alternative. Yet statistics indicated that, excluding enemy action, so-called pilot error was the most frequent cause of casualties. If the man was persuaded to carry on, he might jeopardise the success of a mission, and perhaps expose his own and other aircraft in the formation to enemy attack. Therefore, the decision to "talk the pilot into it" had to be based on an accurate summing up of the situation. If it was considered that an aircrew member was fit for flying, any further action required to make him face up to his obligations was administrative and not medical, and could involve loss of rank and disgrace. The injustice resulting from a wrong decision would be serious and, unless malingering could be proved beyond all doubt, this step was not taken in the R.A.A.F. Even if it was justified, the threat might prevent others who genuinely needed medical aid from seeking it. Here again, therefore, disposal had to be handled discreetly and quickly.

CHAPTER 23

MEDICAL ASPECTS OF RECRUITING AND TRAINING

AFTER the establishment of the R.A.A.F. in the early 'twenties it was the practice for a medical board, consisting of a medical officer and executive officer, supported by medical clerical staff, to tour the capital cities from time to time to examine potential recruits. An attempt was made then to introduce basic medical standards for enlistment similar to those of the R.A.F., but it was not until the initiation of the Empire Air Training Scheme in 1940, when uniformity of standards for aircrew throughout the British Commonwealth became necessary, that R.A.F. standards were wholly adopted by the R.A.A.F.; with a few exceptions this uniformity was maintained during the war; where there were differences, the R.A.A.F. standards were higher than those of the R.A.F.

In the R.A.F. in 1941 a shortage of aircrew was feared, with the result that some modification of standards was made, particularly on the ophthalmic side. The pilot visual-acuity standard was relaxed to 6/18 uncorrected, and corrective goggles were provided. More gross degrees of heterophoria were accepted and orthoptic training given. The R.A.A.F., however, did not relax visual acuity beyond 6/12 uncorrected, and no degree of heterophoria beyond the standard laid down for peacetime was accepted. The wisdom of this policy was borne out by events, and the R.A.F. found that their departures from peacetime standards were of doubtful value.

A medical category of "Colour Vision Defective Unsafe—Daylight Flying, non-operational" was introduced into the R.A.F. in order to use such colour defectives on instructional duties. This category was discussed in Australia as early as January 1940, but was never adopted in the R.A.A.F.

The R.A.F. also accepted men with certain physical disabilities which in peacetime would have excluded them, the philosophy being that their service was for the duration of the war plus twelve months only.

In 1943 the R.A.A.F. Medical Directorate prescribed that visual acuity of fighter pilots, as distinct from pilots serving in other roles, should be a minimum of 6/6 without glasses.

High visual acuity was required of air gunners, but these were not, however, required to have "normal" ocular muscle balance. This posed some categorisation problems, for the pilot could have a lower visual acuity than the air gunner—6/12—but was required to fall within the range of "normality" in ocular muscle balance. These factors led to a sorting out of trainee aircrew personnel. Some difficulties were resolved by the introduction of aircrew selection boards on which the medical officer was invited to sit in special cases.

In 1942, with the introduction of new types of aircraft, the questions arose of desirable leg length and sitting height in pilots, these two factors being associated respectively with ability to apply full rudder and to achieve

an adequate field of vision from the cockpit. A minimum leg length of 29 inches was agreed upon, but it was subsequently found that in certain single-engined aircraft this was insufficient to give some individuals full rudder control. If this condition was combined with a short trunk, it became virtually impossible for them to perform efficiently in service aircraft types in this category. "Cockpit tests" in service aircraft were therefore introduced by recruit centres to replace the arbitrary figure in doubtful cases.

In the same year the R.A.F. issued a comprehensive list of revised medical standards and medical classifications for all aircrew categories then in being. At this stage the various additional R.A.F. musterings of non-pilot aircrew had not been adopted in the R.A.A.F. The R.A.F. standards, however, were circulated to all R.A.A.F. medical officers with the proviso that they would not be applicable until such time as each particular non-pilot mustering had been established within the R.A.A.F. A number of these R.A.F. non-pilot aircrew musterings were eventually incorporated in the R.A.A.F. aircrew structure.

As early as 1940 the Minister for Air had raised the question of the need for separate physical standards for army men and air force ground staffs and the then Chief of Air Staff, Air Chief Marshal Sir Charles Burnett, had directed that all R.A.A.F. personnel were to be enlisted for service anywhere in the world. However, the medical classifications Class I and Class II, though not unequivocally defined as signifying fitness for "full duty" and "home duty" respectively, were forced upon the medical authorities by the executive branch, the intention being not to exclude any useful person from R.A.A.F. service. Thus the wartime R.A.A.F., in its development, failed to meet the 1940 ideal of a Service 100 per cent medically fit for duty anywhere in the world.

In November 1943, as a result of the emergence of a pattern of disability associated with service in New Guinea, the medical sub-category "non-tropical" was introduced. After discussion with the army it was agreed that men with certain medical conditions which previously would have excluded them might be accepted, provided such conditions were stationary and unlikely to be aggravated by service. Later it was laid down that a medical category of Class II for airmen, and the corresponding A4hBh for officers, limited service to the Australian mainland. If the suffix "non-tropical" was added, such personnel could not be employed north of the Tropic of Capricorn.

With the advent of manpower direction, pressure was brought to bear upon the R.A.A.F. to accept recruits who were fit Class II by army standards, as it frequently happened that men who had been failed at an R.A.A.F. recruiting centre were subsequently accepted as fit Class I or Class II by the army. "Universal service personnel" called up compulsorily were the subject of much discussion between the executive branches of the air force and army; a radically changed outlook was forced upon the R.A.A.F. and the adoption of uniform standards for army and air force ground staff now appeared desirable. On 11th October

1943 a conference was held of representatives of the Services and the Director-General of Manpower, after which basic minimum standards for ground staff were accepted by the R.A.A.F., including a Visual III Class, and certain other common standards were adopted for the two Services. The air force, however, had a large number of special technical musterings which the army did not have, for which higher physical standards, particularly visual and auditory, were necessary. These requirements were maintained.

By 1945 there was a tendency in the R.A.A.F. to return to the higher standards of peacetime, a tendency already discernible in the R.A.F. In retrospect it is considered that the maintenance of higher physical standards for so long and their resumption as early as possible, not only contributed to efficiency in the Service but accounted also for the relatively small number of medical boards necessary in the R.A.A.F. Furthermore, it is notable that R.A.A.F. personnel made relatively fewer claims on the Repatriation Department for medical disabilities, as distinct from disabilities arising from war injuries, than their army counterparts.

The employment at the various R.A.A.F. recruit centres, from the very outbreak of war, of full-time medical staffs familiar with aircrew and ground staff examination techniques also paid dividends. It permitted the same type and quality of examination by trained personnel to be made throughout the Commonwealth, and so a uniform medical standard was maintained in the Service. It was felt that this system was superior to the employment of part-time medical examiners and that it would logically result in reduction to a minimum of acceptance of volunteers liable to become pensionable risks soon after enlistment.

From the time of its inception until 1928, the findings of medical boards carried out within the R.A.A.F. were confirmed by its Director of Medical Services. In 1928, however, when the R.A.A.F. medical service was placed under the control of the D.G.M.S. (Army), he became responsible for confirmation of the findings of R.A.A.F. medical boards, which were forwarded to him from all parts of the Commonwealth through D.M.S. (Air). This state of affairs existed even after the outbreak of war. Early in 1940 it was not unusual for the then D.M.S. (Air) to send medical board findings for confirmation to the D.G.M.S. (Army) and to find them returned, confirmed by an officer of subordinate rank with no practical knowledge of air force organisation or procedure. With the separation of the air force medical service from army control in April 1940, confirmation of medical board findings in the air force once again became the responsibility of the D.M.S. (Air).

Until 1940 medical boards were largely confined to "medical boards on invalids" (P/M. 17). With the development of the Service under war conditions, medical boards for the purpose of stabilising medical categories came into being (P/M. 44, 45). The confirmation of both types of boards was made by the D.D.G.M.S., since those (area) Principal

Medical Officers who had received rapid promotion, had had little opportunity to obtain experience of certain aspects of air force policy.

With the establishment of special medical boards, such as Central Medical Board, Melbourne, and Sydney Medical Board, the confirmation of P/M. 44, 45 type boards was vested in the board president, and in States other than Victoria and New South Wales in the P.M.O. of the group or area concerned. In 1945 confirmation of medical boards of type P/M. 17 was delegated to the P.M.O's, although control was maintained by the Medical Directorate, where all findings had to pass the scrutiny of the D.D.G.M.S. and S.O.M.S. from professional and administrative aspects respectively.

The supervision of P/M. 17 type boards by the Medical Directorate until the P.M.O's were thoroughly familiar with their responsibilities to the Treasury and the Repatriation Commission bore good results, and the Repatriation Commission in due course expressed its appreciation of the quality of the work done.

Aircrew Training. After the Empire Air Training Scheme had been firmly established aircrew trainees were on enlistment immediately transported to various Initial Training Schools, where they obtained preliminary training in basic subjects; at the end of this course they were designated to continue training either as pilots, air observers or air gunners.

In selecting men who would be successful in these different roles, many factors were taken into consideration, such as age and intellectual calibre. Younger men were chosen as pilots, older men as air observers; a high intellectual standard was required for navigators, but for air gunners not so high. Ability to coordinate the action of brain, hands and feet was necessary in pilots, and the medical officers at the Initial Training Schools tested each man's capacity in this respect, using an apparatus called the Wright Coordination Machine.

It was appreciated by the Medical Directorate that the medical officers at the I.T.S's could also give valuable advice to the Aircrew Category Selection Boards. This suggestion was at first rejected by the Directorate of Training. However, when difficulties inevitably developed in the allotment of aircrew the suggestion was made again, and in due course an instruction was issued that the Selection Boards should seek the advice of the Senior Medical Officer of the I.T.S. when making their selections. In practice this instruction was not often followed because of the opposition of those in charge of the boards, usually World War I pilot veterans. The Flying Personnel Research Units, however, did valuable work in the application of psychological principles to the differential selection of aircrew trainees for training as pilots, air observers or air gunners.

The subsequent training of pilots was carried out at Elementary Flying Training Schools, where they were taught to fly a simple light aircraft.

The medical officer's duties at the E.F.T.S. included careful follow-up of inoculations and vaccinations, which were not usually complete by the time the trainees left the I.T.S. He was also often able to give the commanding officer valuable advice on many problems concerning the flying

training of pupils. This involved consideration of the flying instructors. Many of these men at the E.F.T.S., and at other training units as well, were disgruntled by what they considered to be the relatively unimportant and routine nature of their duties, particularly in the early years of the war when trained men were scarce, and those that were available had to be kept on training duties for long periods. The position was complicated by the fact that many had returned from operational service physically and mentally fatigued and requiring rehabilitation. It was necessary for the station medical officer of any training unit to know the instructors well. He could then assess their condition, and make recommendations to the commanding officer concerning leave, relief from instructional duties, and so on.

The number of pupils allotted to each instructor at the E.F.T.S. was usually four or five, and as a result there was talk in the flight rooms and messes of instructor fatigue. Many instructors, due to their frustrated state of mind, were prepared to believe that any lack of progress was due entirely to deficiencies in the pupil and not to their inability to teach, and so it became the medical officer's duty to investigate the suitability or otherwise of the pupil material. In interviewing the "scrubbed" pupils, the medical officer needed to be familiar with the difficulties under which they laboured, and to "speak the same language". As a result, a request was made and granted for selected medical officers to undergo flying training courses. The following, either before or during the war, had flying training: Air Commodore E. A. Daley, Group Captains W. D. Counsell and R. B. Davis, Wing Commanders J. G. Brown, S. F. Reid, R. R. McDonald and V. E. Knight, Squadron Leaders S. M. L. Dunstone, J. W. L. Atkinson, J. S. Burgess, J. C. Sangster, F. T. Humphery, S. M. Morson, H. R. Hawkins, F. I. Wootten and M. H. B. Robinson (parachute course), Flight Lieutenants N. J. Chamberlain, A. J. Lundie, C. H. Noack, M. Zilko, J. H. Smith, N. M. Kater and H. H. Jackson.

It was easier for these medical officers to assess the capacity of pupils, and having experienced the various methods of instruction used by individual instructors, to suggest changes of instructor and pupil relationship, often with advantage to both. After one batch of "scrubbed" pupils had been interviewed by medical officers five were placed back on course and four eventually graduated; the remaining one proved to be unsuitable temperamentally.

At an E.F.T.S. the medical section's crash organisation included the following: ambulance, with medical orderly, parked alongside the duty pilot's tower at all times when flying training was going on, provision of "crash beds" in station sick-quarters, and duty medical personnel. The response to an alarm (frequently a false alarm) was somewhat more dramatic and urgent than necessary, the intention being that trainees should be impressed with the fact that prompt medical aid was available in the event of accident or injury. Serious flying accidents in E.F.T.S's were rare. At Cunderdin, Western Australia, for example, the number of serious

accidents during two years of E.F.T.S. training was three, with no deaths resulting.

A number of "satellite" aerodromes were used for E.F.T.S. purposes. To comply with the standard of medical coverage established for home units, a medical orderly should have been in attendance while flying was in progress. This was impossible, however, because of staff shortages, and a compromise was made by having available at these airfields a "driver, motor transport", trained in first aid.

Airsickness was not a common complaint for which men appeared on sick parade: it was, however, frequent in minor degrees among E.F.T.S. trainees, but most of those affected were able to overcome the disability by perseverance and by gaining confidence and adjusting themselves to the newly-experienced visual and vestibular stimuli of flight. The occasional trainee referred to medical sections for persistent airsickness was either unfit for flying by reason of an abnormally sensitive vestibular apparatus, often indicated by previous personal history and by tests, or else was unsound to a greater or less degree in his psychological make-up. In treating the less severe cases a measure of success was obtained with mild sedation, either a barbiturate or hyoscine, combined with encouragement and suggestion.

Ocular defects accounted for a small number of trainees who reported on sick parades. A common difficulty was persistently faulty landings due apparently to inability to judge the height of the aircraft above the ground in the final stages of the approach. Repeatedly it was found in these cases that, although the trainee was passed on enlistment as fit for aircrew, his ocular muscle balance test figures closely approached the maximum acceptable disparity from mean "normal" values. Some trainees who showed exceptional all-round ability and soundness were nursed through with extra dual hours. At least one trainee was referred back to an Initial Training School for a period of orthoptic training, and upon return to the flying unit was reported by the instructor to be vastly improved; he was subsequently passed out to the S.F.T.S. with a good flying grading.

One case of ocular pathology overlooked at the initial medical examination was discovered on ophthalmoscopic examination. The trainee had a small circular area of choroiditis in the fundus of the right eye: while flying, the resulting blind spot continually gave him the impression that another aircraft was approaching from the right side and behind.

Psychological defects sent many trainees to sick parades: some of them reported voluntarily, and others were referred by Chief Flying Instructors. The signs and symptoms were varied, but in general were those of anxiety neurosis in a mild form. The disabilities were considered to be functional when no organic disease was discoverable, and the previous personal histories of most trainees in this group revealed obvious though mild personality inadequacies and maladjustments. These trainees were usually "scrubbed" from their courses because they were unable to satisfy Chief

Flying Instructors with their flying progress, and not for specifically medical reasons.

It was felt that waste of time, effort and money could have been avoided had a special medical board been formed to handle these cases, with a medical officer on it familiar with the psychological effects engendered in some individuals by the stress of flying duties. It appeared certain that men who developed even minor signs and symptoms of psychological disturbance so early in their flying training were unlikely to become sound operational pilots, though in some instances they might have completed their full flying-training course. This type of individual fell out of the ranks either at the S.F.T.S., the O.T.U., or soon after joining an operational squadron.

Elementary Flying Training Schools were located at Parafield, South Australia; Archerfield and Lowood, Queensland; Essendon and Benalla, Victoria; Mascot, Temora, Narromine, Narrandera and Tamworth, New South Wales; Western Junction, Tasmania; and Cunderdin, Western Australia.

The aircrew who graduated from the E.F.T.S's were sent either to twin-engined or single-engined Service Flying Training Schools, the former intended to turn out bomber and the latter fighter pilots. S.F.T.S. medical officers also were often able to give information to their commanding officers concerning the temperaments of the trainees, pointing to their suitability for either fighter or bomber pilot duties.

Service Flying Training Schools were located at Point Cook, Victoria; Uranquinty, Deniliquin and Wagga Wagga, New South Wales; Amberley and Bundaberg, Queensland; Geraldton, Western Australia; and Mallala, South Australia.

From the S.F.T.S. the successful trainee pilots passed on to the O.T.U's for training in the type of aircraft actually being used in operations. The organisation of an O.T.U. Medical Section was similar to that of any flying training station. However, as a result of the nature of the training and the more sophisticated types of aircraft in use, crashes were more frequent, and the medical staff was always alert and prepared to start quickly for the scene of any accident.

At No. 2 O.T.U. Mildura a system of radio telephony between ambulance, sick-quarters and searching aircraft was developed. The terrain over which exercises were carried out was desolate and uneven, and it would have been possible for a searching ambulance to pass by without noticing a crashed aircraft lying in a depression only a few yards away. The operational aircraft sometimes crashed many miles from base, and, if the search was not well organised, the pilot, if not already dead, might die before help reached him.

As soon as a crash was reported the duty pilot rang the duty medical officer and told him the general direction in which to go. As further details came in the medical officer was advised by the base radio telephone station. If any difficulty was met in locating the crashed plane, an aircraft tuned in to an emergency frequency was scrambled. The radio telephone

station took a radio bearing on the ambulance and the aircraft flew out to intercept it. As soon as air-to-ground communication was established the aircraft continued the search and advised the ambulance of the necessary track to follow to reach the site of the crash.

Often the ambulance radio was not powerful enough to contact base after travelling long distances and information was relayed through by the searching aircraft. The sick-quarters could then have everything prepared, including a blood-donor panel for emergency transfusions. All this enabled precious hours to be saved, and an injured pilot's chances of survival were thereby increased.

The O.T.U. medical officer lectured and discussed with the trainees such subjects as tropical hygiene and the physiological effects of oxygen-lack, acceleration, fatigue and fear; he also tried to instil in them the habit of wearing correct flying clothing. The aspiring squadron medical officer gradually gained facility in the handling of headstrong young men: when he eventually joined a squadron he met numbers of old friends from the O.T.U., and was able to settle in rapidly.

The first O.T.U. (a joint single-engined and twin-engined unit) opened at Nhill, Victoria, on 7th December 1941. Before long O.T.U's had been established at Bairnsdale, East Sale and Mildura, Victoria; and at Rathmines, New South Wales. Later, such units were located also at Williamtown, Nowra, Tocumwal and Parkes, New South Wales.

Trainee Air Observers were posted to Air Observers' Schools, where they were taught the finer points of reconnaissance and photography, then to Air Navigators' Schools, where they were given advanced training in navigation. Active flying was carried on at both of these units. Medical problems in the Air Navigation Schools arose mainly as the result of inexperienced members of aircrews having to undertake long trips, especially at night, in variable weather conditions. In the winter months protection against cold was a major problem, as Anson aircraft were used, and these were unheated and extremely draughty.

Aircrew trainees destined to be Wireless Operators/Air Gunners passed from I.T.S's to a Wireless Air Gunners' School at which the training, mostly on the ground, was strenuous and lasted about six months. Problems which the medical officer met there included general mental fatigue in trainees of only average mentality, who found the job too big for them, and problems of hearing associated with the constant use of headphones in the taking and sending of Morse. These two conditions combined sometimes led to established nervous instability, with the result that a few trainees had to be removed from their courses.

On graduation from W.A.G. School, Wireless Operator/Air Gunners passed to a Bombing and Gunnery School (B.A.G.S.). B.A.G.S's were located at Evans Head, New South Wales, and Port Pirie, South Australia, and there, as the name implies, techniques of air gunnery and bombing (for non-pilot aircrew) were taught. The principal aviation medical problems encountered at B.A.G.S's were airsickness and apprehension in trainees subjected for the first time to relatively violent aerial

manoeuvring in the course of bombing and gunnery exercises, and the effects of disgruntlement in staff pilots left for long periods on these relatively routine duties. Especially in the first half of the war, flying activity at B.A.G.S's was intense, but major accidents were very few; single-engined Fairey Battle aircraft were used exclusively in this training phase.

Eventually both Air Observers and Wireless Operators/Air Gunners proceeded to an O.T.U. There they joined the pilots, and were formed into crews for operational duties.

All ground staff after enlistment at recruiting centres was transported to recruit depots, which were established initially within a short distance of each capital city. From the recruit depots those who were to be trained for trades and other technical occupations in the Service were sent to the various Schools of Technical Training and other special training schools. The latter included the Medical Training Unit, the Signals Training School, Radar Training School and Works Training Unit. Advanced final training for some trainees destined for engineering trade musterings was given at the Engineering School, of which there was one only, located at Ascot Vale, Victoria.

Medical responsibilities in the recruit depots consisted primarily of ensuring that all recruits were correctly vaccinated, inoculated and blood grouped, and that the relevant entries were made in paybooks and medical documents, and recorded on identity discs.

Constant attention had to be given by the medical officer to overcrowding in the huts where recruits were housed. Because of the accelerated intake after the entry of Japan into the war, accommodation in the recruit depots was very much overtaxed.

Men attending Schools of Technical Training suffered from similar overcrowding, and this was more serious because their accommodation was usually in existing buildings which were not suitable for housing of large bodies of men. However, this could not be avoided with the facilities available; accommodation had to be found for S.T.T. instructional and administrative staff in proximity to the schools. In Melbourne and Adelaide the Exhibition Buildings were used as living quarters, and in Geelong, Victoria, various hotels and similar buildings were appropriated. The medical officer's duties included devising means of making the best of overcrowded living quarters. At No. 4 S.T.T., Adelaide, overcrowding was particularly rife, and the incidence of illness correspondingly high: this unit had more cases of cerebro-spinal meningitis than any other in the Service. The incidence of illness in the Schools of Technical Training generally was higher than in any other R.A.A.F. training schools, and was certainly due to the inadequate and improvised accommodation, combined perhaps with a poorer standard of constitutional resistance in the trainees.

Medical officers also inspected the conditions under which trainees were working. As a result of their efforts, improvements were made in the lighting and ventilation and general hygiene of schools.

Although accommodation at the Engineering School, Royal Agricultural Showgrounds, Ascot Vale, was most unsuitable for large numbers of men, the wisdom of taking over the site could not be doubted: 8,000 trainees were accommodated there within twelve months, and such a large intake would have been impossible if a new school had had to be built. Because men were accommodated in such structures as sheds, huts, grandstands, and stock pavilions, constant supervision by medical officers was necessary. Almost weekly, buildings were condemned, and the low incidence of illness at this school was due in a large measure to the energy of the various medical officers responsible for its communal health in the early months.

The Engineering School had the greatest concentration of personnel in the Service—8,000 men, later increasing to 10,000. A hospital with a minimum of 300 beds to cover ordinary sickness rates was required, and, as mentioned, No. 2 R.A.A.F. Hospital was established at Ascot Vale to serve the needs of the Engineering School and adjacent metropolitan units.

Remembering the epidemics of the 1914-18 War—cerebro-spinal meningitis, measles, mumps and the like—it was at first thought that a large isolation hospital was necessary, and a horse pavilion was converted for the purpose: it could accommodate 500 contacts and had separate catering facilities. This large isolation block was turned over to No. 2 Hospital for use as an infectious diseases ward. Because of the nature of the building it was never particularly satisfactory, but it would have been useful had any large-scale epidemic broken out.

At the end of their courses of training aircrew and ground staff were posted to embarkation depots, where they were appropriately kitted and given final medical examination before going to operational theatres. Every effort had been made to see that the men had been blood-grouped and had had all vaccinations and inoculations before they completed their training, but at the embarkation depots a further check was made of documents, paybooks and identity discs.

Sometimes vaccinations, inoculations and the like were not completed before embarkation. The medical officers of the embarkation depots then prepared a list for the escorting medical officer of the draft, so that everything necessary could be done in transit.

Some aircrew trainees from I.T.S. or E.F.T.S. were sent in small batches either to Canada or Rhodesia, where additional flying training was carried out: aircrew who had been fully trained in Australia were transported direct to the Middle East or the United Kingdom. A medical escort, consisting of a medical officer, nursing sister and medical orderly, was sent with each draft. During the trip the medical officer, in addition to completing vaccinations and inoculations, attended to the other medical needs of the men and checked medical documents to ensure that they were complete and in order. As he was frequently the only medical officer on board, he was also responsible for the medical care of the crew and any passengers carried. With the Education and the Physical Training Instruc-

tors, he took part in maintaining physical fitness during these voyages, the relative inactivity of which was sometimes an irritation to trainees fresh from a period of intensive training.

The opportunity was usually taken to give trainees lectures on first aid, personal hygiene, sanitation, nutrition, principles of accommodation, tropical and venereal diseases, and aviation medical subjects including survival topics.

An Australian Air Liaison Office had been established in Ottawa, Canada, for some time before a medical officer was appointed to the staff. The first medical liaison officer, Squadron Leader R. V. Pridmore, arrived at Halifax, Canada, on 30th April 1942. His duties included:

(*a*) Keeping in touch with research activities conducted in Canada, particularly in regard to aviation medicine, and forwarding to Australia progress reports of such activities. Reporting on the medical organisation or general medical policy of the R.C.A.F., and miscellaneous matters thought to be of interest to the R.A.A.F.

(*b*) The supervision in a general way of the health of R.A.A.F. personnel in Canada.

(*c*) The collection and dispatch to Australia of medical documents and returns dealing with hospitalisation of R.A.A.F. personnel. All medical boards recommending repatriation to Australia were approved by the M.L.O. before posting action was taken.

Canada was early in the field of aviation medicine research, and at the time of arrival of the M.L.O. research was being conducted in various localities under the auspices of the National Research Council. A wide variety of subjects was being investigated, including pre-selection measures, flying clothing, oxygen equipment, night vision, decompression sickness, and physiological effects of acceleration. The M.L.O. attended meetings of the various committees, and paid regular visits to research institutions.

Monthly reports were submitted to the D.G.M.S., and Australia was thus kept informed of progress in the various projects. The Royal Canadian Air Force was also kept informed through the M.L.O. of work being done in Australia.

Two R.A.A.F. medical officers engaged in research in Australia were sent to Canada and the United States to gain first-hand information on aviation medical research—Flight Lieutenant Morson in 1942 and Flight Lieutenant D. H. Le Messurier in 1943. Both officers covered an immense amount of research activity and made many valuable contacts.

The R.C.A.F. was responsible for medical attention to R.A.A.F. trainees in Canada. Conditions in Canada differed greatly from those in Australia. For six months of the year the men lived in heated buildings, and out of doors were exposed to temperatures of many degrees below zero. Despite this dramatic change from accustomed conditions, the general health of the R.A.A.F. in Canada was good. It appeared to take a few months for the men to become acclimatised and during this period upper respiratory infections were common: the first "cold" caught in Canada would be somewhat more severe than usual. After this settling in period, however, general health was satisfactory and the morbidity

rate not unduly high. Soon after arrival in Canada Australian trainees were inoculated against diphtheria and scarlet fever in accordance with R.C.A.F. procedure. Scarlet fever was nevertheless responsible for a considerable loss of man hours in both Australian and Canadian trainees.

Apart from the liaison office staff, no R.A.A.F. men were employed on ground duties in Canada. Therefore all men who became medically unfit for flying duties were repatriated to Australia. The 1943 figures show that 4.2 per cent of R.A.A.F. personnel were repatriated for medical reasons. Airsickness was responsible for 12 to 15 per cent of the medical repatriations. Psychoneuroses were another important causal factor. In 1942 only about 9 per cent of medical repatriations were due to psychoneurotic conditions, but in 1943 this figure rose to some 28 per cent.

CHAPTER 24

R.A.A.F. SQUADRONS ABROAD

AT the outbreak of war the only R.A.A.F. personnel on duty in England were those on the strength of the Air Liaison Office, Australia House, and the aircrew of No. 10 Squadron, R.A.A.F., who had arrived in England before the war to take delivery of some Sunderland flying-boats, which they were to fly back to Australia. Instead, the Australian Government decided that they should remain in England to operate under Coastal Command on anti-submarine and other duties, the squadron to be completed by the addition of ground personnel.

At this time there were no R.A.A.F. medical officers on service in England, but Flight Lieutenant J. Grayton Brown was in London carrying out post-graduate work while on twelve months' leave of absence from the active Citizen Air Force. Wing Commander Daley asked the Air Board to call up Grayton Brown for full-time duty at the Air Liaison Office, and this was done on 22nd January 1940. His duties were to advise the Air Liaison Office concerning medical arrangements for No. 10 Squadron and for other members of the R.A.A.F. in England, and to send regular reports to the Directorate of R.A.A.F. Medical Services on the activities and policy of the R.A.F. Medical Service. In April 1940 Grayton Brown was recalled to Australia to join the staff of the Directorate of Medical Services, and in November Flight Lieutenant E. H. Anderson was posted from No. 10 Squadron to replace him. Anderson instituted a medical records section at the Air Liaison Office which ensured that the medical documents of members of the R.A.A.F. overseas were kept up to date and copies sent to Australia for repatriation records. He requested and was granted a special staff of medical clerks and orderlies for this work.

When Australia opened an Overseas Headquarters in London at Kodak House, Kingsway, in 1941, it contained a medical and later a rehabilitation section; a Principal Medical Officer was included on the staff, and when necessary an assistant was posted to help him. The P.M.O., as well as carrying out liaison duties, acted as adviser to the Air Officer Commanding Overseas Headquarters on all medical matters associated with R.A.A.F. squadrons, E.A.T.S. aircrew in "mixed" squadrons and later R.A.A.F. E.A.T.S. squadrons serving in the United Kingdom and the Middle East. Medical control of R.A.A.F. squadrons and of members of the R.A.A.F. in the Middle East was maintained through a medical liaison officer.

Anderson was the first P.M.O. He was an excellent administrator, and very much *persona grata* with the R.A.F. When he returned to Australia at the end of 1943 he was followed by Wing Commander M. L. Creightmore. In 1944 Creightmore was succeeded by Wing Commander W. M. Borland, who was promoted to group captain and served as P.M.O. until

the end of the war. Squadron Leader S. W. Lush was medical liaison officer on the staff of Middle East Headquarters from early 1943 to 1945. He was the first member of the R.A.A.F. to hold this appointment.

Australians trained under the Empire Air Training Scheme had begun to arrive in England in December 1940. With Australians who had completed their training at home and E.A.T.S. trainees from other Commonwealth countries they went to No. 3 Personnel Reception Centre at Bournemouth. This town enjoyed complete immunity from air attack until one Sunday afternoon in May 1943, when the Germans made a hit-and-run raid which did enormous damage; over 140 people were killed, among them six members of the R.A.A.F., and many buildings at the reception centre, including the sick-quarters, were destroyed. The centre was then moved to Brighton, where Squadron Leader A. J. Harker became the S.M.O. He was assisted by Squadron Leader V. J. Odlum. Sick parades were large. Venereal disease, which was rife among the different nationalities at the centre, was responsible for some of the attendances, although the medical section managed to keep it to a minimum among the Australians. A few cases of pneumonia were seen, one with the dreaded complication of pneumococcal meningitis. The patient was transferred to the local infectious diseases hospital, and treated with the latest sulpha drugs, but he did not respond and his recovery was despaired of. Odlum had been impressed by reports of the results achieved by the newly discovered penicillin in the treatment of severe bacterial infections, and he contacted Sir Hugh Cairns, who was in charge of the Hughes Head Injuries Hospital, Oxford, where the infections had been treated. Sir Hugh readily agreed to treat the Australian, and he was brought to Oxford in a borrowed ambulance; his response to the new treatment was dramatic, and he returned to Brighton completely cured, later going on to an operational squadron where he won the D.F.C. He was one of the first cases of pneumococcal meningitis to be cured by penicillin.

After leaving the reception centre aircrew were posted to R.A.F. squadrons in Coastal, Fighter or Bomber Command, to No. 10 Squadron or to new R.A.A.F. squadrons formed overseas. R.A.A.F. medical officers were eventually posted to all R.A.A.F. squadrons. As these frequently operated from the same station as R.A.F. squadrons a slight awkwardness arose from the lack of uniformity on the administrative side between the R.A.F. and the R.A.A.F. Medical Services. The R.A.F. adhered rigidly to establishments. If a flight lieutenant was promoted to squadron leader he was not kept in a flight lieutenant's job. As already mentioned, the R.A.A.F., recognising the importance of the role of the medical officer in the squadron, felt that experienced men should fill it, and the squadron medical officer often held the rank of squadron leader and even of wing commander. The result was that the R.A.A.F. squadron medical officer was frequently senior in rank to the commanding officer of the station and sometimes even of the base. However, there was so much goodwill between the two Services that no friction ever developed.

The problems of the R.A.A.F. squadron medical officers were not ones of organisation, for their units were operating from established airfields with an already functioning medical system, and all investigation, hospital and rehabilitation facilities were supplied either by civilian or one of the British Service hospitals. In the case of civilian hospitals the squadron medical officer was likely to feel a faint uneasiness, as the standard of treatment in some of the smaller ones was variable.

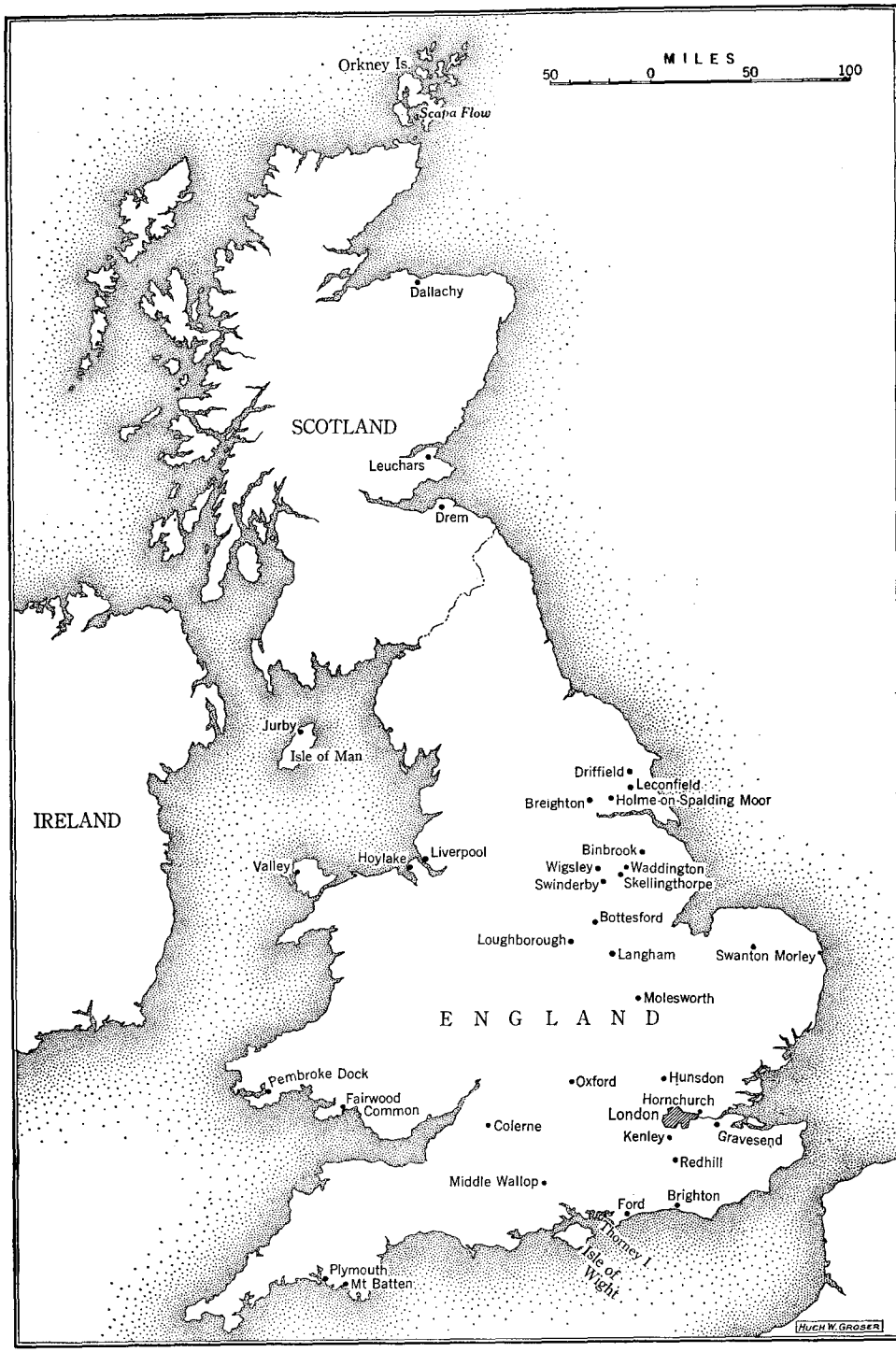
It was thought that the wide dispersal of R.A.A.F. medical officers might induce a sense of isolation, and to avoid this conferences were held at three-monthly intervals in the office of the P.M.O. in London, to which all were invited. Medical officers were also given opportunities for professional advancement, facilities being readily available for special courses in such subjects as orthopaedics, anaesthetics and aviation medicine.

Coastal Command: No. 10 Squadron, which had soon been completed by the arrival of the necessary ground staff, was stationed at Pembroke Dock in Wales. Its duties were reconnaissance, anti-submarine sweeps and escort of convoys. Flight Lieutenant R. J. Cato, an Australian on service with the R.A.F., was appointed squadron medical officer.

The winter of 1939-40 was particularly severe, and at one time 25 per cent of the men were ill with influenza. The squadron also suffered a small outbreak of cerebro-spinal meningitis which, however, was quickly controlled by the use of sulphapyridine. A circumstance which caused some alarm was the high incidence of upper respiratory tract infections, and the Air Ministry supplied special ultra-violet lamps for short courses of treatment. These, however, were mostly useful for the fine sun tan they produced. Sub-acute catarrhal respiratory tract changes were to be seen repeatedly in young Australians arriving in England. The condition, although mild, lowered flying efficiency to such an extent that those who did not become acclimatised had to be boarded and returned to Australia. In a warmer climate they quickly regained full flying efficiency.

In April 1940 No. 10 Squadron was transferred to Mount Batten, Plymouth, to police the transit area for enemy submarines in the Bay of Biscay. The base was immediately adjoining a naval hospital, and all serious cases were sent there. In April 1941 the squadron returned to Pembroke Dock. It now had an R.A.A.F. medical officer, Flight Lieutenant S. Thomson. Squadron medical officers made it a practice to do as much flying as possible for the purpose of sustaining morale, and Thomson who went up on a routine trial flight on 5th December 1941 was killed when the aircraft crashed. He was succeeded by Flight Lieutenant D. T. Shortridge, who remained with the squadron until July 1943 when Flight Lieutenant G. C. Wilson became the squadron medical officer.

In January 1942 No. 10 Squadron returned to Mount Batten to resume patrols in the Bay of Biscay. These were for the most part uneventful as the submarines usually made the passage submerged. The flying-boats, however, were menaced by enemy fighter aircraft, mostly Ju-88's, and in June one of the Sunderlands was shot down while on an air-sea rescue


MILES
50 0 50 100
Orkney Is.
Scapa Flow
Dallachy
SCOTLAND
Leuchars
Drem
Jurby
Isle of Man
IRELAND
Valley
Hoylake
Liverpool
Driffield
Leconfield
Breighton
Holme-on-Spalding Moor
Binbrook
Wigsley
Waddington
Swinderby
Skellingthorpe
Bottesford
Loughborough
Langham
Swanton Morley
Molesworth
ENGLAND
Pembroke Dock
Fairwood Common
Oxford
Hunsdon
Hornchurch
London
Colerne
Kenley
Gravesend
Redhill
Middle Wallop
Ford
Brighton
Thorney I.
Isle of Wight
Plymouth
Mt Batten
HUGH W. GROSER

search. This was the squadron's first loss from enemy action. In the next year the flying-boats faced another menace when the U-boats were instructed to stay on the surface and fight it out. Surfaced U-boats damaged several of the Sunderlands, and in August succeeded in bringing one down, although six members of the crew were rescued. But this tactic was a double-edged weapon and, after a few months during which they suffered heavy losses, the U-boats reverted to their former practice of travelling submerged by day and surfacing to ventilate and charge at night.

As well as the Australians who were joining R.A.F. squadrons in Coastal Command, two new Australian squadrons were added to the Command during 1942. They were No. 461, another Sunderland squadron, and No. 455 (Hampdens), which was transferred from Bomber Command in April. The torpedo bombers of No. 455 Squadron took part in strikes against enemy shipping off the Norwegian coast. In August the squadron medical officer, Flight Lieutenant J. H. Bilton, with a party of ground staff, left by sea for northern Russia. Next month 16 of the squadron's aircraft followed, two being lost during the difficult flight. A large Allied convoy carrying war material was on its way to Russia, and in a striking position in Alten Fiord in Norway were the German naval units—*Tirpitz, Admiral Scheer, Prince Eugen, Lutzow, Hipper,* as well as many smaller vessels. The task of the Hampdens was to protect the convoy. In Russia arctic weather and constant bombing raids by German aircraft kept the squadron medical officer on the alert, but there was little illness and the injuries suffered during the raids were minor ones. The convoy reached port without being attacked, and eventually the squadron's aircraft were handed over to Russia, the crews returning to England by sea. In February 1943 Bilton was succeeded by Flight Lieutenant R. D. Macbeth. The squadron was then based at Leuchars in Scotland, together with a R.N.Z.A.F. and two R.A.F. squadrons. Macbeth looked after both the Australians and New Zealanders. They were very healthy, and morale was the main problem. When there was little activity lethargy and despondency were likely to descend on the men, but with an increase in the tempo of operations enthusiasm quickly returned. Then the medical officer's difficulty was to get hold of aircrew for routine immunisation against diphtheria, typhoid and tetanus. They used evasive tactics for as long as they could, as the immunisation shots usually provoked a temperature which made flying impossible for a day or two. Macbeth found that, although aircrew rarely had cause to seek medical advice, they gained enormously in confidence from the knowledge that a medical officer was at hand to help them if they needed him. For this reason whenever men were due back from training flights or from operations he made a point of waiting in the ambulance on the runway in case there were mishaps on landing. These vigils sometimes lasted many hours.

Quarantine duties were an interesting phase of medical work at Leuchars. British Empire Airways ran a civilian air service from Leuchars to Stockholm, and there was a constant stream of diplomats, secret agents and refugees passing through the terminal. These had to be given a care-

ful medical screening, in particular against typhus, which was rife in eastern Europe but not in the United Kingdom.

In 1944 the squadron moved to Langham in Norfolk to support the Normandy landing by attacks on German convoys on the Dutch, Danish and Norwegian coasts. In the weeks preceding the landing American patients were often treated in the station sick-quarters. The pilots of Fortresses returning from softening-up raids on the Continent would land at the first aerodrome they saw if they had wounded on board, and this was frequently Langham. The patients were given emergency treatment, held for a few days, and then transferred to one of their own medical units.

From Langham No. 455 moved to Dallachy, where operations continued against enemy shipping. In December 1943 the squadron had converted to Beaufighters. Usually, if the pilot and navigator of one of these two-seaters were seriously injured, the aircraft did not get back, but one crew managed to do so. They had been bombing German shipping in a Norwegian fiord when their aircraft was badly damaged by enemy fire; the pilot sustained a broken arm and multiple shrapnel wounds, and the navigator was also wounded by shrapnel, but with great doggedness they managed to bring their aircraft down safely in the Orkneys. Macbeth flew up to look after them, and after a few days' treatment brought them back to Dallachy.

Fighter Command: A number of Australians were in R.A.F. fighter squadrons when war broke out. Some took part in the Battle of France, and the few that survived fought in the Battle of Britain. The first R.A.A.F. fighter squadrons were formed in 1941—Nos. 452 and 457 (Spitfires) and No. 456, a night-fighter squadron equipped with Defiants and later with Beaufighters.

No. 452 was based at Redhill, a satellite of Kenley. The sick-quarters, like those at most other stations, were about a mile from the airfield, a site dictated by the heavy bombings of the previous year. Although enemy raids had become only hit-and-run affairs, there was a possibility that the enemy would drop paratroops, and the sick-quarters attendants were given arms for the defence of their patients. An R.A.A.F. medical officer, Flight Lieutenant W. A. Seldon, joined the squadron in 1941, but the sick-quarters attendants were members of the R.A.F., and some of them who came from the north of Scotland created a language problem for the Australians.

The main duty of the squadron was to carry out offensive sweeps over enemy-occupied territory. Casualties were high. Because of the intensity of operations aircrews were retained at Redhill only for three or four months, after which they were sent for a rest period on exchange with crews of No. 457 Squadron, which was based at Jurby on the Isle of Man. Operations at Jurby consisted of patrols and convoy escort duties, and brought few contacts with the enemy. In March 1942 No. 457 replaced No. 452 at Redhill, but later in the year both squadrons were transferred to Australia.

No. 456 Squadron had been formed at Valley in June. Flight Lieutenant T. Burfitt, who joined the squadron in mid-1941, was its first R.A.A.F. medical officer. At that stage bed patients were admitted to the station sick-quarters, a rather primitive farmhouse about half a mile from the airfield, and sick parades and inspections were carried out in a "Medical Inspection Room", a wooden hut near the tarmac. Later new sick-quarters were built with central heating and hot and cold water laid on, and the old inspection room was used as an aid post.

Valley was responsible for the air defence of the Midlands and, as well as No. 456 Squadron, the station usually held a day-fighter and an air-sea rescue squadron, a target towing flight, a sector operations room, an army unit for aerodrome defence, and other miscellaneous units, which brought the station population to about 2,500. With medical officers coming and going all the time, Burfitt was frequently the only medical officer on hand. His task was complicated by the diversity of nationalities he had to treat—Australian, English, Irish, Scottish, Welsh (some of whom "had not the English"), South Africans, Canadians, Americans, Czechs, Poles, Belgians and French. There was some venereal disease, and scabies and rashes were prevalent, but not so much among the Australians, who usually had a high standard of personal cleanliness. There were many flying accidents; generally they were either fatal or else the crews escaped unscathed. One aircraft crashed just off the shore in a heavy sea, and a flight sergeant of No. 456 Squadron, an expert in life-saving, succeeded in rescuing the crew.

Morale was generally high, but the quietness of the sector was a cause of some despondency among aircrew, and ground staff were disappointed at being passed over for promotion. Both these causes of complaint were soon removed. Promotions came through and, in March 1943, the squadron, which in December had been converted to Mosquitos, was transferred to Middle Wallop. There was now a good deal of activity and casualties rose, due more to a combination of the hazards of night flying and the weather than to enemy action. After subsequent brief stays at Colerne, and Fairwood Common in south Wales the squadron moved early in 1944 to Ford, the chief emergency aerodrome in south-east England, from which it was to give night-fighter cover to the Normandy landing.

At the beginning of 1943 Burfitt had been succeeded by Flight Lieutenant F. S. Parle, who was to remain with the squadron until the end of the war. Alarms and excursions were frequent at Ford. On one occasion when Parle was driving in the ambulance he saw a fire some miles away in the direction of the airfield. He found on arrival at the scene that a Flying Fortress had crashed into what looked like a sea of oil drums. He helped to get the men from the burning aircraft, and while doing so was dismayed to learn that what he had thought was a collection of oil drums was actually the bomb dump.

An interesting medical feature at Ford was a night vision training unit, set up by Parle with the enthusiastic cooperation of the station commander and the men. It had been discovered that, although there were wide varia-

tions in the capacity of individuals to see at night, the night vision of everyone was basically the same, the variations being merely in the capacity to use night vision. Parle trained the men to use their peripheral or night vision, mainly by games and exercise. Basket-ball played on a blacked-out court with lines and balls painted white was particularly helpful.

In the days which followed the invasion of Europe the squadron's medical arrangements were put to a severe strain. The Americans had a system of medical evacuation which usually functioned very smoothly. Their casualties after being given emergency treatment at advanced dressing stations in France were evacuated by air to a base in the Midlands for further treatment and were then flown home to America where they often arrived within a week of being wounded. On occasions, however, the base in the Midlands was shut down by weather, and once without notice 14 Dakotas landed at Ford. They contained 80 stretcher cases and walking wounded. The station sick-quarters had only about 20 beds, and Parle immediately took over the airmen's mess, where the patients were fed and given further emergency treatment. The British A.R.P. organisation then supplied ambulances which dispersed the patients to hospitals throughout the area. This happened twice in the next fortnight, 200 patients being landed on one occasion. After that the Americans sent a medical unit to Ford, but it never operated as the weather remained favourable while the rest of the evacuations were proceeding.

No. 453 Squadron (Spitfires) had been re-formed at Drem in June 1942, becoming operational in September when it moved to Hornchurch. Its medical officer was Squadron Leader H. W. R. Sharp. This unit went to Normandy and right through to Berlin.

Another fighter squadron, No. 464 (Mosquitos) also went to the Continent. Originally a Ventura squadron in Bomber Command, No. 464 began to operate in Fighter Command from Hunsdon in Hertfordshire in conjunction with an R.A.F. and an R.N.Z.A.F. squadron. The three squadrons took part in the night strafing and bombing of bridges, trains and other transport in occupied Europe and in a number of pin-point daylight raids—against Amiens Prison (with the object of releasing several hundred Free French who were to be executed the next day), against three Gestapo headquarters in Denmark; and many V.2 sites. Squadron Leader Odlum joined the unit as medical officer in December 1943, and soon afterwards No. 464 moved to Swanton Morley in Norfolk to obtain experience of living under canvas. Odlum took an ambulance, tents, medical equipment and two nursing orderlies, and for several weeks the squadron and its medical section operated under field conditions, a valuable dress rehearsal for the part it was to play in forthcoming events across the Channel.

After returning to Hunsdon for a brief period, the squadron moved to Gravesend on the Thames Estuary, where it again worked under canvas. The aerodrome had grass strips, and many aircraft and crews were lost because of their treacherous surface. This was the time of the buzz-bombs,

and Gravesend was in the direct line of the launching sites, so that the squadron welcomed a further move, this time to Thorney Island on the south coast. By now the landing in Normandy had been made, and nightly the Mosquitos strafed enemy positions behind the Caen beach-head. The medical officer spent his nights either in the ambulance at the end of the runway or in the control tower, living, eating and sleeping with the aircrews, and conferring constantly with the commanding officers of the squadrons on the medical aspect of operations.

At Thorney Island Odlum had occasion to give morphia injections to a number of casualties. He used the morphia tubunics contained in the first-aid packs issued to all aircrew. The results were disappointing and he requested an analysis of the tubunics' contents, which revealed that the morphia had been inactivated by the metal lining of the tubunic. Odlum advised headquarters; all air force first-aid packs in England were immediately recalled, and the tubunics replaced with new models containing a lining which did not affect their contents.

Early in 1945 the squadron crossed the Channel to Rosieres near Amiens, taking over a former German aerodrome, including the sick-quarters. Thence the squadron moved to Meilsbrook near Brussels. More and more intensive effort against the retreating enemy was called for, and nerves in the squadron were taut. One pilot, who was almost at the end of his third tour, was in a highly emotional state and his men were reluctant to fly with him. Odlum was forced to take the rather extreme step of flying to England to request his posting elsewhere.

Despite the high tempo of operations, morale throughout Fighter Command was excellent. There was in the R.A.A.F. squadrons a sprinkling of other nationalities, and this was possibly a contributing factor, as was the spirit of friendly competition engendered by the presence on the same station of squadrons of the different Allied nations—British, Australian, Canadian, South African and New Zealand.

Bomber Command: The first R.A.A.F. squadron in Bomber Command, No. 455 (Hampdens), began to form in June 1941, and was based at Swinderby and its satellites—Skellingthorpe and Wigsley. Hitherto the only Australians in the Command had been a small number who were scattered throughout R.A.F. squadrons. Two other R.A.A.F. squadrons, Nos. 458 and 460, were formed towards the end of the year, both equipped with Wellingtons. No. 458 was based at Holme-on-Spalding Moor and No. 460 at Molesworth. No. 460 did not become immediately operational but No. 458 joined with No. 455 in a limited offensive against German targets until it was sent to the Middle East in January 1942. In the same month No. 460 Squadron moved to Breighton, where it converted to Lancasters. Its medical officer was an Englishman in the R.A.A.F., Squadron Leader G. Roberts.

During April 1942 operations in Bomber Command were intensified. In No. 5 Group, to which No. 455 Squadron belonged, the procedure was for headquarters to inquire how many pilots had not operated on both the previous nights and to allocate that number to the current night's

operations. On some men this imposed an almost intolerable strain, and in April, when very tired pilots had been detailed for operations under this system, Bilton, the squadron medical officer, took the courageous step of grounding three pilots until they had had a full night's rest. Group Headquarters was both critical and angry, but the pilots remained grounded for that night.[1] As already mentioned No. 455 Squadron was transferred to Coastal Command in April.

By the beginning of 1943 the Allies had the enemy on the defensive, and casualties in Coastal and Fighter Command were falling. Most of the Australians arriving in England were, therefore, absorbed in Bomber Command, either in R.A.F. units, including the Pathfinder Force, or in R.A.A.F. units. An R.A.A.F. Ventura squadron, No. 464, had begun to operate from Feltwell against coastal targets in December 1942 but because of the unsuitability of its aircraft for bombing operations it was transferred to Fighter Command in June 1943. Two new Australian squadrons, Nos. 466 and 467, became operational during January 1943. No. 466 (Wellingtons) was based at Driffield, although it moved almost immediately to Leconfield. The Australians found conditions at Leconfield congenial. This was a permanent R.A.F. station with members of the W.A.A.F. on the staff. Quarters for all ranks were comfortable; a picture theatre was added later and there were facilities for football and cricket, which were played when operations and the weather permitted. Men who were seriously ill were sent to the cottage hospitals, which in this area were satisfactory, and the minor sick to the excellent station sick-quarters, which had a bomb-proof area with oxygen and resuscitation equipment ready to hand. A near-by manor house "Molescroft", which had about 40 beds, acted as an auxiliary sick-quarters, and there the squadron medical officer, Squadron Leader John H. Coto, treated not only the men from No. 466 Squadron but also those sent to him from R.A.F. squadrons in the neighbourhood.

No. 467 Squadron (Lancasters) was based at Bottesford. The medical officer, Squadron Leader V. S. Howarth, had to cope with an epidemic of diphtheria in April. He confined the squadron to camp for ten days, although even during this period of isolation it continued to take part in operations. After one man had died he was successful in checking the outbreak.

Apart from this, there was little serious illness among aircrew. Nor did they often seek treatment for injuries sustained during operations. For the most part, they went missing or came back intact. There were, of course, many crash landings, and Roberts, the medical officer of No. 460 Squadron, played a leading part in rescuing members of the crew when one of the squadron's Lancasters crashed in flames near the airfield.

No. 460 Squadron moved to Binbrook in May 1943 and No. 467 Squadron to Waddington. A fourth Australian squadron, No. 463 (Lancasters), which had been formed in November 1943, also operated from

[1] J. H. W. Lawson, *The Story of 455 (R.A.A.F.) Squadron* (1951), p. 31.

Waddington, Howarth acting as medical officer to all the Australians on the station.

The Australians took a proportional part in Bomber Command's offensive against the heavily defended industrial cities of Germany, France and Italy. Casualties were heavy. Between March and July 1943 Nos. 460, 466 and 467 Squadrons lost 29, 20 and 13 crews respectively, the very high rate for Nos. 460 and 466 Squadrons being about the same as that for Bomber Command generally. In a subsequent series of raids aimed at crippling Berlin the Australian squadrons also suffered heavily, No. 460, which played the major role, having the heaviest losses—18 crews in the three months from November 1943 to February 1944.

The effect on morale was not pronounced. Some airmen became jittery as their tour neared its end, particularly if it was their second tour, and some after a very hazardous operation. One crew, which had been forced to bale out over France and which managed to reach England safely, approached the medical officer as soon as they got back and said that they did not want to fly again with their captain. The latter, an experienced pilot, had just been decorated for the competence and courage displayed on his last mission. The crew could not or would not give any reason for their attitude, but it was obvious that they had lost confidence either in him or in themselves. In such a situation the medical officer had no authority to act; all he could do was talk the matter over with the station commander, who was usually understanding and cooperative. On this occasion it was decided that the pilot, who was approaching the end of his tour, should be given leave and the crew broken up. This, however, was an isolated incident, and morale throughout the Command was extremely high. Of all the crews passing through their hands at Leconfield and Waddington respectively, Coto saw only two "moral fibre cases", and Squadron Leader Harker, who soon after D-Day succeeded Howarth as the medical officer of Nos. 467 and 463 Squadrons, reported that he did not come across even one. The R.A.A.F. bomber squadrons, like the R.A.A.F. squadrons in Coastal and Fighter Command, were not exclusively Australian in composition. As well as Australians, they included Englishmen, Canadians, South Africans, New Zealanders and Poles. This arrangement, although displeasing to the Australian Government, was approved by aircrew. They seemed to regard themselves as representatives of their country, and were stimulated to give of their best. Some medical officers were also of the opinion that morale was boosted by the presence of W.A.A.F's on the stations.

While high morale was to be expected of aircrew, who did not usually reach operational squadrons unless sound, a lower standard in ground staff would not have been surprising, particularly as their conditions were not conducive to contentment. Promotion was less rapid for them than it would have been had they stayed in Australia; they had no glory and only vicarious excitement. Yet night after night they continued to service and bomb up the aircraft, in winter often working outdoors in snow or

blizzards. They grumbled, of course, but they carried on, and few ever appeared on sick parade.

All Australians in the United Kingdom requiring medical boards had to appear before No. 1 Central Medical Board of the R.A.F. This was a tremendous organisation with almost every department headed by specialists who were nationally famous. If there was a suggestion of soullessness in its mode of operating this was probably unavoidable in view of the large numbers which had to be dealt with. However, so that the Australian view-point should not be lost sight of where Australians were concerned, the Air Board late in 1943 posted Squadron Leader J. D. Russell as Australian representative on the Board. Russell, a psychiatrist, served on the C.M.B. until 1945, when he was succeeded by Wing Commander I. G. McLean, a specialist physician.

Men appearing before the Board included not only those who were ill or had been injured or were suffering from operational fatigue, but also "moral fibre cases", that is, those in whom no organic or nervous condition could be found but who either created excuses to evade their flying duties or who refused to fly. Very fairly, the R.A.F. did not discriminate between the psycho-neurotic, the man who said "I have terrible headaches (or other complaints) which prevent my flying, but I will be happy to fly again as soon as I am cured", and the man who said honestly "I won't fly again. I'm afraid." The final assessment was an executive not a medical decision. Men who for whatever reason declined to fly were first examined by the medical officer who made his diagnosis; they were then passed on to another officer who considered the factor of stress in each case. A man who had many hours of operational flying to his credit or who had suffered some devastating experience would be judged less severely than another who had just emerged from an operational training unit. Men who broke down under stress were usually removed from aircrew and given suitable and not unpleasant employment on the ground. Those assessed as "moral fibre cases" were treated very sternly, being stripped of their wings and given a menial role in the Service. This treatment was not punitive in aim. With the country in peril, the R.A.F. wished to keep flying for as long as possible as many men as possible, and the fear of being branded as a "moral fibre case" undoubtedly caused many waverers to persevere.

Another aspect of medical work in the United Kingdom was rehabilitation. Expensively trained aircrew and technical musterings who had been incapacitated required a rehabilitation program specially arranged to refit them for the skilled tasks they had to perform and one which would ensure their early return to duty. An appropriate environment for the rehabilitation of officers was provided at Loughborough and for other ranks at Hoylake. Air Commodore Hurley arranged for several R.A.A.F. medical officers, including Squadron Leader G. G. Burniston and Flight Lieutenant D. O. Longmuir, to work with the R.A.F. at these establishments. When they returned to Australia they were familiar with R.A.F.

policy and were able to establish rehabilitation units in Australia along R.A.F. lines, which paid worthwhile dividends in the saving of manpower. The development of rehabilitation units in the R.A.A.F. is described in some detail in a later chapter.

At the end of hostilities both the R.A.F. and the R.A.A.F. medical services in the United Kingdom made earnest preparations for the reception of released prisoners, many of whom, it was feared, would be suffering from physical and psychiatric disorders. Lest sick prisoners should be unwisely feted and indulged, instructions were given that all were to be interviewed and medically examined before being turned over to relations and friends. The latter, meantime, had been supplied with brochures warning them to be prepared for irrational behaviour on the part of the released prisoners and offering advice on how to cope with it.

An R.A.A.F. P.O.W. Reception Unit was established at Brighton. Squadron Leader Harker, the medical officer-in-charge, had a large staff, and the Red Cross generously supplied all requests for amenities. A few of the prisoners passing through were ill. One man, a competent pilot who had almost reached the end of a successful tour when captured, was diagnosed by the psychiatrist on the staff as a schizophrenic, and he committed suicide, although most carefully watched. Some of the other prisoners were suffering from malnutrition. These were mostly prisoners from the north-east of Germany who had been sent westward in forced marches when the Russians were advancing. Prisoners from southern Germany, who had been in static camps, had few disabilities either physical or mental, unless possibly latent ones. Squadron Leader Russell was detailed to give medical attention to 750 men of the A.I.F. who had been prisoners of war and who were returning to Australia by ship, but throughout the whole voyage he was consulted by only one man.

MALAYA

In August 1940, as part of the general deployment of forces to meet the possibility of war with Japan, the R.A.A.F. sent a wing to Singapore. It consisted of a headquarters, Nos. 1 and 8 Squadrons (Hudsons) and, later, No. 21 (Wirraways). Two medical officers, Squadron Leader R. R. Macdonald and Flight Lieutenant F. F. Ellis and a staff of medical orderlies accompanied the wing. At first all three squadrons were based on Singapore Island, No. 21 Squadron at the R.A.F. station of Seletar, where Macdonald and Ellis were also posted to gain experience of the local methods of administration, and Nos. 1 and 8 Squadrons at Sembawang.

After two weeks Macdonald was transferred to Sembawang where he became the Senior Medical Officer, Ellis remaining at Seletar. There were a few R.A.F., about 1,200 R.A.A.F. and 3,000 Chinese coolies on the station. The sick-quarters, a large two-storied concrete building, had a theatre, complete except for a steam sterilizer, and a dental surgery. The bed capacity was 10, but there was room for twice that number if neces-

sary. Unfortunately the air conditioning did not function, as part had been lost due to enemy action on the way out from England. A permanent anti-malarial squad of 15 Asians with an overseer in charge, worked in two parties on and around the station, one party on oiling and the other on constructional anti-malarial work. Members of the R.A.A.F. requiring prolonged hospitalisation were not nursed in the station sick-quarters, but were sent to Tanglin Military Hospital. Discipline was rigid there by Australian standards, the men being required to "lie to attention" for the colonel during his rounds, and it was inevitably unpopular. The standard of medical treatment, however, was good.

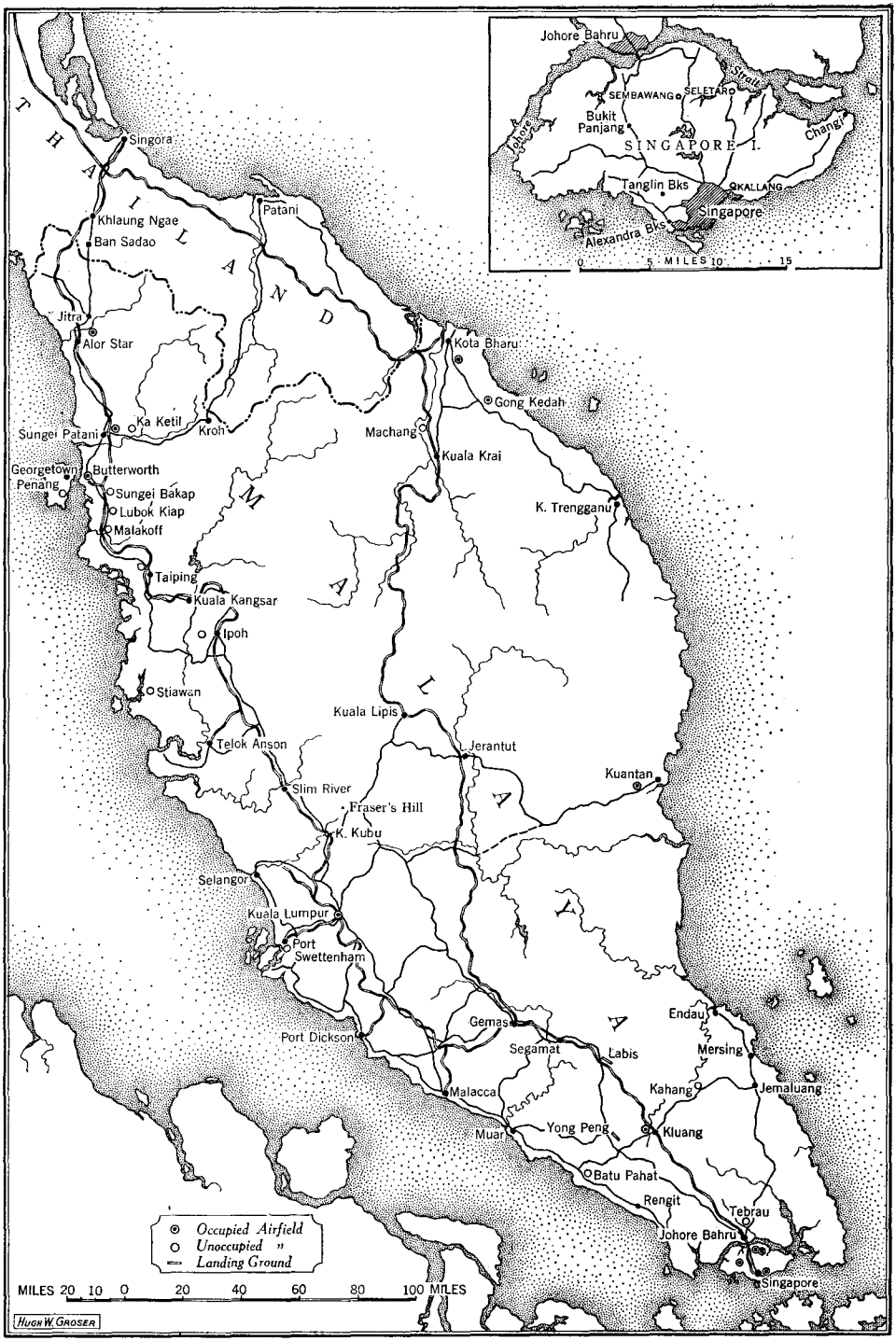
At the beginning of 1941 there was a shortage of doctors in the R.A.F. The British P.M.O. Far East, Group Captain D. G. Boddie, asked that R.A.A.F. medical officers should be posted for service with R.A.F. units in Malaya, and in March and April six more R.A.A.F. medical officers, accompanied by medical orderlies, arrived in Singapore. They were Squadron Leader I. R. Horn and Flight Lieutenants R. C. Gill, S. W. Dobell-Brown, I. L. Miller, P. E. Breheny and L. T. Conlon.

In February 1941 Macdonald went to Kota Bharu where a new station was to be opened. He established medical liaison with the army medical officer in the area and with the civilian hospital, and within two weeks the main body of No. 8 Squadron had moved in, followed a month later by Gill who was posted as station medical officer. In the meantime medical treatment for the 300 to 400 men of the squadron had been provided by a medical orderly. This was not a very happy arrangement, and Gill found on his arrival that there was a good deal of malaria as a result of bad sanitation and lax discipline. Men requiring hospitalisation were not nursed in the sick-quarters, which were pleasantly situated on a river bank, but were sent either to the local civil hospital or to the Alexandra Military Hospital in Singapore, which was a combined Services hospital. The line of evacuation was through the Sembawang Station, which arranged replacements if necessary.

Medical stores were a problem. One set of R.A.F. equipment was intended to last for six months, and fresh supplies had to be requisitioned through a stores depot in England, which sent them out by way of the Cape. Gill had an order outstanding for six months, and as local purchases were not permissible, he managed to hold out until the stores arrived only by exchanging surpluses with the civilian hospital.

Other difficulties arose due to differences in procedure between the R.A.F. and the R.A.A.F. Medical Services. For some time R.A.A.F. medical officers were unable to persuade the R.A.F. P.M.O. that all medical and dental treatment and prostheses for members of the R.A.A.F. serving overseas were provided entirely free of charge. This applied in particular to spectacles and dentures. In the R.A.F. virtually all treatment and issues in these fields were on a repayment basis, except to general duties personnel.

During the squadrons' early days in Malaya there was a great deal of activity and interest. The R.A.A.F. had a goal to reach in establishing


THAILAND
MALAYA
Singora
Patani
Khlaung Ngae
Ban Sadao
Jitra
Alor Star
Ka Ketil
Kroh
Sungei Patani
Georgetown
Penang
Butterworth
Sungei Bakap
Lubok Kiap
Malakoff
Taiping
Kuala Kangsar
Ipoh
Stiawan
Telok Anson
Slim River
Fraser's Hill
K. Kubu
Selangor
Kuala Lumpur
Port Swettenham
Port Dickson
Kota Bharu
Gong Kedah
Machang
Kuala Krai
K. Trengganu
Kuala Lipis
Jerantut
Kuantan
Gemas
Segamat
Labis
Endau
Mersing
Kahang
Jemaluang
Malacca
Muar
Yong Peng
Kluang
Batu Pahat
Rengit
Tebrau
Johore Bahru
Singapore
Johore Bahru
Johore Str.
SEMBAWANG
SELETAR
Straits
Bukit Panjang
SINGAPORE I.
Changi
Tanglin Bks
KALLANG
Singapore
Alexandra Bks
0 5 MILES 10 15
Occupied Airfield
Unoccupied "
Landing Ground
MILES 20 10 0 20 40 60 80 100 MILES
HUGH W. GROSER

their units on an operational basis, and they had the stimulus of competition with the R.A.F., but once the units were established the amount of work dwindled. This slackening of activity coincided with the arrival of thousands of A.I.F. and a loss of interest in the R.A.A.F. by the civilian population, to whom Australians were no longer a novelty. Airmen now began to find life dull. When they went into Singapore, about 14 miles away, they found themselves fettered by restrictions to which their own country had not accustomed them. Non-commissioned men were refused admission to the main hotels and clubs and to many of the cafés. The shops with their rising prices were financially out of bounds, and little was left, except the picture theatres and entertainment parks. On the station an attempt was made to keep the men occupied with organised sport. There was an Olympic pool; tennis and squash were played, and an R.A.A.F. Rugby team, captained by Wing Commander A. L. Walters, was entered in the local competition.

The position of the squadron at Kota Bharu was rather different. The white population was small and the men realised that they must provide their own entertainment. They were also stimulated by the knowledge that the Thailand border was only five miles away. After eight months of inaction, however, they too became discontented and began to sigh for the illusory delights of Singapore.

Similar difficulties arose in regard to leave, for there were few places to which the men could afford to go. While officers were able to stay at the various clubs, there were no recreation or rest camps for airmen. Macdonald found a partial solution through the generosity of Walter Pensler[2] and his fellow executives of the Raub Australian Gold Mines, which were situated some 90 miles north of Kuala Lumpur. They offered facilities for recreation leave to ten or twelve airmen each month, at first in their own homes and later in a house which they set aside for the purpose at Fraser's Hill Station. For most airmen, however, there were two alternatives: either to forego their leave or to spend it on the station.

It was a conviction of the R.A.F. that the tropics were no place for white men. They stood down at midday and did not work in the afternoons and, indeed, complained that R.A.A.F. flying activities after lunch disturbed the traditional afternoon siesta. Practically all the menial jobs, such as cleaning and kitchen duties, were done by native staffs. The R.A.A.F. gradually came to adopt this unfortunate viewpoint, and they also began to feel that, for what was only a garrison job in Malaya, they were missing opportunities for action in the European and North African theatres of war. Promotions were another cause of grievance. They came through finally, but then created a marked surplus of N.C.O's, which was not corrected by the replacement from Australia of men of rank appropriate to the establishment.

On the surface morale did not suffer. The men looked smart; they attended parades; obeyed orders, and paid the ordinary compliments to officers. But on deeper observation a gradual deterioration was noticeable.

[2] Subsequently executed by the Japanese.



(*R.A.A.F.*)

P.M.O's Conference, Overseas Headquarters, London, March 1944. *Left to right*: Wing Commander J. D. Russell, Squadron Leader C. E. M. Anderson; Flight Lieutenant G. Roberts; Squadron Leader A. J. Harker; Flight Lieutenant B. W. Monahan; Squadron Leaders T. H. Donnelly, F. S. Parle; Flight Lieutenant R. D. Macbeth; Wing Commander M. L. Creightmore; Squadron Leader H. W. R. Sharp; Flight Lieutenant V. S. Howarth and Squadron Leader G. C. Wilson.



(*D. T. Shortridge*)

Station sick-quarters, Mount Batten, showing blast wall rising to roof level.



(*R.A.A.F.*)

No. 464 Squadron, including sick-quarters and ambulance, under canvas at Swanton Morley.



(*A. G. McGlynn*)

No. 23 Medical Clearing Station at Noemfoor.



(*A. G. McGlynn*)

Interior of the medical ward of No. 23 M.C.S. at Noemfoor.



(*R.A.A.F.*)

No. 2 Medical Clearing Station, Milne Bay, February 1944. Sisters Young and Perger are at work in the ward.



(*R.A.A.F.*)

Convalescent patients at No. 24 M.C.S., Nadzab, February 1944.

This became pronounced after June 1941 when many men had completed a twelve months' tour of duty.

In July 1941 Squadron Leader Macdonald was repatriated to Australia after contracting rheumatic fever, and was replaced by Squadron Leader I. H. Cuming, who was assisted by Flight Lieutenant R. M. Alder. Cuming felt that the medical set-up at Sembawang, with the sick-quarters situated in the main building area, would be ineffective in the event of war, and he began to look for a house to act as dispersal sick-quarters. One was eventually secured about a quarter of a mile from the main airfield, and all in-patients were shifted there at the beginning of December.

On 8th December, the day of the Japanese landing at Kota Bharu, the disposition of the R.A.A.F. squadrons was: No. 1 Squadron at Kota Bharu, where it had replaced No. 8 Squadron; No. 8 Squadron at Kuantan, its new base after it had been rested at Sembawang; No. 21 Squadron, now armed with Buffaloes, at Sungei Patani, and the newly arrived No. 453 Squadron (Buffaloes) at Sembawang. Gill had been relieved at Kota Bharu on 1st December but he stayed on for a few days to help his successor, leaving for Singapore on the last train before the Japanese landed.

It was a Hudson of No. 1 Squadron which made the first sighting of the Japanese invasion convoys; other aircraft of the squadron sank one of the enemy transports and damaged others, and, when the Japanese were attempting to get ashore, caused havoc among the landing craft and among those of the enemy who reached the beaches. In this engagement two of the squadron's ten serviceable aircraft were lost and most of the others damaged. By the morning of the 8th the ground staff had them serviceable again, but the airfield was being bombed continuously, and when it seemed that it was being attacked from the ground as well, Air Headquarters ordered the squadron's withdrawal to Singapore, to which No. 8 Squadron at Kuantan had also been ordered to withdraw.

On the west coast, too, the R.A.F. and R.A.A.F. squadrons were falling back—from Alor Star, Sungei Patani and Butterworth. Kuala Lumpur, which was only a civil strip, was brought into use by the air force, and No. 453 Squadron, which had replaced No. 21, used it as an advanced base. In the middle of December Gill went up to Kuala Lumpur, where he again met Horn. In their outmoded aircraft the pilots of No. 453 Squadron fought valiantly in support of the hard-pressed ground forces; by the 22nd only four of the sixteen Buffaloes were serviceable, and this unit too was ordered back to Singapore. Horn and Gill went with it, and on 26th January they were flown to Sumatra.

Meanwhile at Sembawang the station strength, which had been in the region of 500 in the days immediately preceding Japan's attack, swelled to 1,200 with the influx of the squadrons from the north. Practically all members of the R.A.A.F. in Malaya were now concentrated there, as well as two Dutch squadrons, equipped with Glenn Martins, and some

hundreds of Dutch and Javanese troops. The new arrivals were short of equipment, particularly clothing; the Asian servants began to leave, and messing presented great difficulties.

Singapore was raided for the first time on 8th December, and after that raids became a daily occurrence. Sembawang escaped the attentions of enemy aircraft until 17th January when it was bombed with great accuracy; about 15 men were killed and 20 injured, most of the casualties being Chinese coolies; numbers of aircraft were destroyed; the water and sewerage systems were disrupted, and many of the buildings where the men were housed were made uninhabitable. The original sick-quarters received a direct hit; the lower floor was badly damaged and the upper demolished, but it was still possible to use the building as a collecting centre and first-aid post.

Almost complete dispersal was now forced upon the station. In the dispersal areas discipline relaxed in the absence of strict supervision, and there were difficulties of hygiene arising from insufficient training. The spirit of the men, however, was if anything uplifted by the raid. The R.A.F. faced problems of aerodrome maintenance as more and more of the Chinese coolies left, but at Sembawang, when 200 airmen were called on to make repairs to the strip, 500 turned out to do the job, including most of the medical officers and orderlies, and within a few hours it was serviceable again.

The squadrons were as active as deficiencies of aircraft would permit. The Hudsons and Glenn Martins carried out reconnaissance and bombing raids in support of the retreating British forces, and the Buffaloes attempted to give fighter support.

On 20th January Sembawang was raided again; about 8 men were killed and 12 injured, the Chinese coolies again suffering the most severely. At this time there were four medical officers on the station; Flight Lieutenant Alder, the acting Senior Medical Officer in the absence of Squadron Leader Cuming, who had been admitted as a patient to the 2/13th A.G.H., Flight Lieutenant Conlon and two Dutch medical officers. The station's dentist, Flight Lieutenant A. F. B. Stone, supervised the collection of casualties after the raids and cooperated with the medical officers in any other way he could.

Soon after this raid No. 8 Squadron was withdrawn to Palembang in Sumatra. A third raid on the 22nd, which was concentrated on the airfield, caused further damage and No. 1 Squadron and the two Dutch squadrons were also withdrawn to Palembang. No. 21 Squadron, which had lost most of its aircraft, had already left. No. 453 Squadron and a nucleus of R.A.A.F. headquarters staff, including the medical section, remained—about 60 men in all.

It had been found that the dispersal sick-quarters was too close to the target area, and as most of the patients were men who had been affected by bombing, it was proposed to set up a new sick-quarters about three miles away on the main road into the city. When this could not be arranged patients were sent to a dispersal point every morning about

the time a raid was expected. This was a satisfactory expedient, except on one occasion when the enemy aircraft overshot the airfield and dropped some bombs among the affected men.

On another morning when an alert was sounded some of the aircraft of No. 453 Squadron went up to try and intercept the Japanese bombers. One of the Buffaloes was shot down and the men in the trenches at Sembawang could see the pilot descending by parachute about two miles away. Alder and a medical orderly jumped into an ambulance and went to search for him. He was found in an Indian infantry camp, being very well looked after. He told Alder that he had a bomber in his sights and was about to fire when a Zero which had come up behind gave him a full burst, holing his petrol tanks. Petrol began to pour into the cockpit and the fumes were quickly overpowering him, but he managed to bale out and pull the rip cord before losing consciousness. He remembered nothing of his descent until he regained consciousness when about 30 feet from the ground. He landed in a tree in the middle of the Indian camp, fearful all the time of being fired on as a Japanese parachutist. The Indians did, in fact, think he was Japanese but instead of shooting kept well clear, leaving him helpless in the tree. When he gave forth with a few well chosen Australian adjectives some British officers were quickly summoned and they helped him down, uninjured except for a heel grazed by a bullet which had ploughed through the heel of his boot.

By 31st January the last of the troops had retreated to Singapore and the causeway linking the island with Johore was blown. The Japanese started shelling from the other side of the strait and British artillery retaliated from positions at the rear of Sembawang. The British officer of an Indian artillery battery operating on the boundary of the aerodrome reported that one of his men had been killed in a barrage which was still going on, and he requested that he be picked up immediately as the morale of the Indian troops would otherwise suffer. To reach the man Alder and an orderly, Sergeant Berry, had to drive over the aerodrome in full view of one of the Japanese artillery observation posts. They carried out this task without waste of time.

It had been intended that Sembawang should act as an advanced operational base for the Hudson squadrons in Sumatra but aircraft could no longer be landed there—No. 453 Squadron had already left—and an order was given that the station should be evacuated on 11th February. Everything which could be of use to the enemy was to be denied, except the water and medical supplies, which were to be left for the use of the army. Cuming, who had returned from hospital a few weeks before, divided the medical section into two parties and on 10th February sent one party under Alder to a flat in the Cathay Buildings in Singapore. The next day Sembawang was evacuated in two convoys. Some medical orderlies accompanied the first convoy and the S.M.O. and the rest of the orderlies went out with the second. After some delays the two medical parties met and made immediately for the waterfront. When they arrived

they learned that the ship in which they were to have travelled had left half an hour before.

Fortunately there was space in another ship, *Kedah,* and the medical party embarked, leaving Singapore early on the morning of the 12th in a convoy which included *Empire Star, Ipoh* and the British cruiser, *Durban.* Their destination was Batavia, and although attacked by Japanese aircraft on the way, they arrived safely on the 13th.

Headquarters (F.E.) medical personnel had then been in Batavia for more than a week but had not become organised and there was no medical equipment available, except such emergency supplies as could be obtained from the Dutch military hospital. The day after the R.A.A.F. medical party arrived a ship put in carrying about 150 members of the R.A.A.F. whose original transport had been sunk; they had been in the water some 18 hours before being rescued. Most were sunburned or otherwise suffering from exposure and many were shocked, but they had to be nursed on concrete floors, except those who were sufficiently ill to be sent to the Dutch military hospital. Alder offered his services to this hospital. He was told that his help would be welcome but that it was needed more by a British hospital which was forming in an empty convent. He went there and found that medical help was indeed needed, as many wounded were beginning to come in. Also working at this hospital were a few Australian army nurses who had left Singapore only a short time before.

Meanwhile the Japanese had attacked Palembang. The remnants of Nos. 1 and 8 Squadrons (R.A.A.F.) took part in bombing sorties against the invasion fleet but the Japanese forced a landing and were steadily gaining control of the island. A further withdrawal of the squadrons and of R.A.A.F. Headquarters staff to Java was unavoidable.

As already mentioned, Gill had left Singapore for Sumatra on the 26th January. When he arrived at Oosthaven it was obvious to him that resistance to the Japanese would soon collapse on the island. There was no one to tell him what to do, and, although he had no equipment, orderlies, transport or money, he began to organise an evacuation unit. There was a civilian hospital in the town which was suitable for conversion to a transit hospital, and a Dutch bacteriologist who had been left in command was happy to relinquish his responsibility. Gill persuaded an R.A.F. medical officer passing through Sumatra to help him, and they managed to increase the hospital's capacity from 50 to 100. As patients came down to the port in ambulances with medical officers and orderlies their disposition was arranged; patients unfit to travel immediately were sent to the hospital, and the medical officers and orderlies were assigned to the ships in such numbers as were needed.

The seemingly invincible Japanese continued to advance. The defence of Java was not considered practicable, and it was planned to evacuate most of the R.A.A.F. on the island to Australia. One party, including the headquarters staff, left on the 21st February in an old oil burner, the *Thepsatri Nawa.* Cuming sent out with them Alder and all the medical

orderlies with the exception of four volunteers. They travelled uncomfortably but reached Fremantle without mishap on the 5th March.

Cuming intended to form a medical section with the four volunteer medical orderlies to support the operations of the remaining Hudsons of Nos. 1 and 8 Squadrons. This plan was not put into effect. A slow ship, the *Edendale,* was leaving Batavia on 22nd February, and at very short notice a further 130 members of the R.A.A.F. were ordered to embark. It was necessary for a medical officer to accompany them and, as no other was available, the S.M.O. had to come out with the four orderlies. He did so on receiving an undertaking from the R.A.F. that one of the remaining R.A.A.F. medical officers would be sent to the Hudson squadrons. In view of this hurried departure the only medical equipment taken was one medical pannier, which proved to be most unfortunate as there was a good deal of sickness in the ship.

Sick rates during the Malayan campaign were not high.

Malaria: A great deal of detailed work on mosquito control had been done on the island in peacetime, and very few cases of malaria occurred among the Australians, except for a minor outbreak of B.T. malaria on the south side of Singapore Island. The main areas of population on the mainland were also well controlled in peacetime. The total number of civilians treated in hospital over the three years before the Japanese invasion was of the order of 50,000. When there was a great influx of army personnel into outlying areas infection became more common. On two occasions when troop formations camped out at night in grossly infected areas more than 50 per cent of the men contracted the disease. The only cases seen in Sembawang were those contracted on the mainland. The air force did not use suppressive quinine to any extent in Malaya, although it was used in Sumatra.

Skin Diseases: All forms of ringworm were prevalent, particularly *tinea pedis, tinea cruris* and *tinea auris.* A skin specialist from Alexandra Hospital examined 146 men of No. 8 Squadron, all of whom had been in Malaya for at least six months. Of these only two had not had some fungus infection of the skin since their arrival. In fact, at the time 86 per cent were infected with *tinea pedis.* On Gill's advice the men bought cheap Chinese wooden slippers and showered in them. The *tinea* then usually cleared up. Several hundred new arrivals were also examined. In some contingents 90 per cent of the men had *tinea pedis,* and about 30 per cent of these gave a past history of infection. Apparently the washing facilities during the three-weeks voyage from Australia were very poor. The incidence among those who used powder as a prophylactic was not less than the general incidence. In No. 8 Squadron *tinea cruris* was also troublesome. It disappeared when it was decided to dispense with the services of the Chinese laundry and to have the men wash their own underclothes. *Tinea auris,* the so-called "Singapore Ear", which was due to a fungus infection of the external auditory canal, was fairly common, but cases with marked swelling of the canal walls and earache were compara-

tively few. One of the methods of treatment which proved reasonably successful was preliminary dehydration with a solution containing three parts of glycerine to four parts of finely ground sucrose, and 5 per cent iodoform. When the ear had ceased to exude fluid it was treated with Castilani's paint or one of the salicylic acid preparations. The most important single item in the treatment was thorough and frequent ear toilets.

One of the native boys developed a curiously effective cure for ringworm. He would crush a leaf from a cactus-like plant, dip it in petrol and rub it on the sore until it bled. Within 48 hours the ringworm was cured.

Prickly heat was common. The best treatment was found to be actual sun-tanning. It was necessary for the sufferer to receive at least an erythema dose of sunlight before relief could be expected; exposure of a lesser degree merely made him sweat more profusely and aggravated the trouble. Acne was another source of concern.

Eye Troubles: Blepharitis and conjunctivitis were common. Men with severe grades of visual refractive error typically experienced trouble with their vision after about six months in the tropics. This also occurred with those who suffered from strabismus; ocular muscles apparently lost some capacity for axial correction, and the men found that they were getting pains behind the eyes and that their vision was deteriorating.

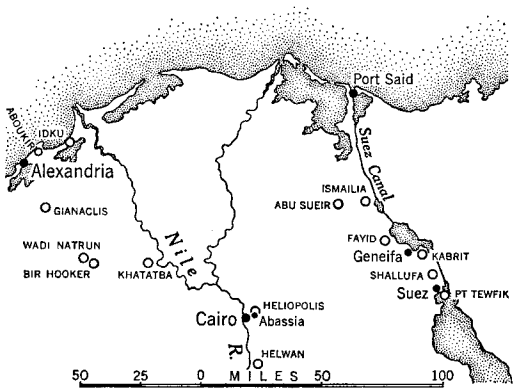
Venereal Diseases: There were in Singapore all the known types of venereal disease, the commonest of which were gonorrhoea and syphilis, but the soft sore and the inguinal *lymphogranuloma* were by no means rare. Over a six months' period hospitalisation at Sembawang for V.D. averaged about 1 per cent of the R.A.A.F. strength. Practically all of the V.D. was contracted from the professional native prostitutes.

MIDDLE EAST AND ITALY

Early in 1940 No. 3 (Army Cooperation) Squadron, which was stationed at Canberra, was ordered to move to the Middle East. There was much competition for the position of medical officer, for which Flight Lieutenant J. C. Laver was eventually chosen.

The squadron arrived at Suez without its aircraft in August, and was split into three sections, which were sent to Ismailia, Aboukir and Abassia, Laver accompanying the Ismailia section. The squadron was committed to the same medical arrangements as R.A.F. units in the area. Major hospitalisation was supplied by the British Army and by No. 21 Medical Receiving Station (R.A.F.), located in the desert to the rear. As in Malaya, the type of discipline in British medical units did not suit Australian patients, and Laver later arranged for them to be passed to A.I.F. hospitals. This in general worked well. However, the A.I.F. system of sending men from hospital to convalescent depots and transit camps where they remained until claimed by their units was wasteful in the case of the R.A.A.F., in which there was no replacement pool, and many members of No. 3 Squadron who had languished for long periods in A.I.F. transit

camps, became exasperated and hitch-hiked back to their unit. The R.A.F. had similar trouble with British Army hospitals, and finally set up a hospital of its own in the Middle East.



In September 1940 the squadron was collected at Helwan and next month, equipped with Gloucester Gladiators, it moved up to Mersa Matruh to support the ground forces in the first Libyan campaign. As the British advanced westward in the desert its aircraft operated from successive advanced landing grounds at Sidi Barrani, Bardia, Tobruk, Derna and, in February 1941, at Benghazi. By April the British were retreating, and No. 3 Squadron provided air cover as it moved back through Maraua, Derna, Tobruk and Buq Buq, halting finally at Sidi Haneish. During the campaign any casualties unlikely to be fit to return to their units within 24 hours were evacuated to No. 21 M.R.S.

After a period of leave at Alexandria the squadron was sent to Lydda in Palestine for conversion to Tomahawks and afterwards took part in the Syrian campaign. Malaria now made its first appearance, causing about a dozen casualties, including the medical officer. General medical arrangements, and in particular those on which No. 3 Squadron relied, showed much improvement. There were more R.A.F. medical receiving stations and more army casualty clearing stations with head, chest and other special surgical units. At the conclusion of the campaign the squadron went to Rayak for a rest period, and in September 1941 it was sent back to Sidi Haneish.

Meanwhile, in July, No. 1 R.A.A.F. Air Ambulance Unit had begun to arrive in the Middle East. This period saw the beginning of a system of mobile surgical first aid at the front line coupled with evacuation by air to base hospitals for major surgical procedures, replacing the former limited front-line surgery. No. 1 R.A.A.F. Air Ambulance Unit pioneered the system, its few aircraft helping in the rearward evacuation of casualties. This was an attempt to "sell" the system to the army medical authorities, an attempt which was not completely successful at this stage owing in part to the lack of large-capacity transport aircraft. However, the commanding officer of the unit, Flight Lieutenant J. G. ("Flaps") MacDonald, and his men did magnificent work and much was learned from their experience, so that when transport aircraft became available later in the war the system was adopted as army policy. The work of the Air Ambulance will be referred to again in a later chapter.

No. 458 Squadron had now been transferred to the Middle East and

enough E.A.T.S. men had arrived to warrant the formation of three new R.A.A.F. squadrons—Nos. 450, 451 and 459—which were to be very active in the subsequent North African campaign. While the medical experiences of one squadron may not have been typical of those of the others, a reasonably complete picture can be obtained from the following condensed accounts of the medical officers of two of the squadrons, which together cover the period from October 1942 to January 1944.

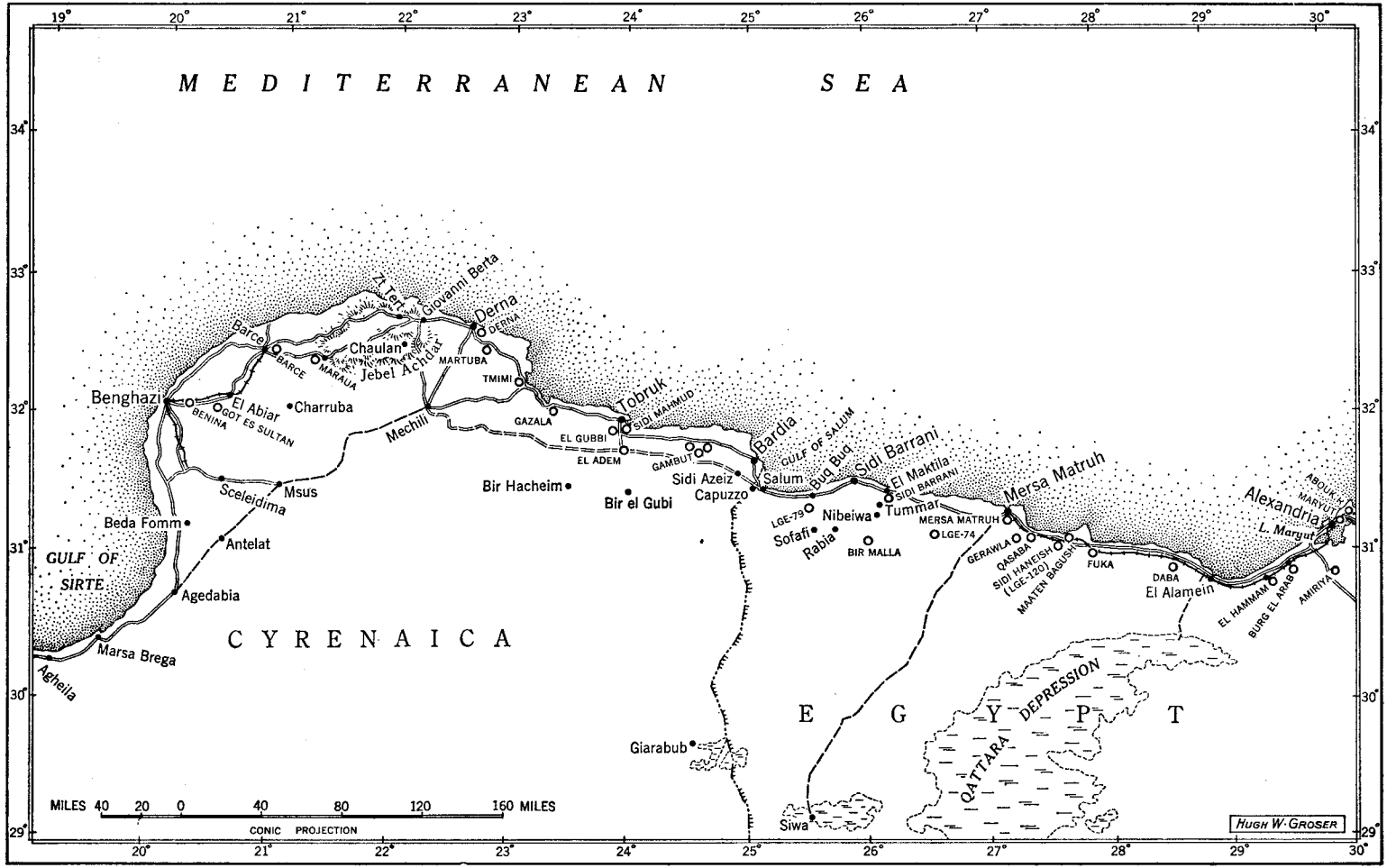
The first account covers the period 14th October 1942 to 17th March 1943 in the Western Desert, Libya, Tripolitania and Tunisia. It is based on the experiences of Squadron Leader Creightmore, the medical officer of No. 450 (Fighter) Squadron.

No. 450 Squadron was part of No. 239 (Composite) Wing, which, in turn, was part of the advanced striking force. It was equipped with Kittyhawks and Warhawks, and its functions were mainly dive bombing, low-level strafing, armed reconnaissance and bomber escort. There was to be comparatively little pure fighter work. The other squadrons in the wing were Nos. 250 and 112 R.A.F., No. 3 R.A.A.F., and an attached American squadron which had recently arrived in the theatre, and was "learning the score".

For purposes of mobility, each squadron was divided into "A" and "B" parties, and a maintenance party. In addition, there was a small group which was known as the fast intermediate party. As the advance continued "A" and "B" were to alternate as forward parties, whose duty was to advance as rapidly as possible the moment an enemy airfield was captured, or when capture appeared imminent. As soon as the area was clear, "A" party, for example, would take over its own section of the dispersal area, and the aircraft would fly forward and operate from the new ground. The fast intermediate party, which consisted of the operations officer and his vehicles and staff, moved rapidly in, and "B" party and the heavy maintenance party followed. If the advance was rapid, "B" party would leap-frog "A", and in turn become the advanced party.

As an example of the degree of mobility attained: between 5th November 1942, the day on which the advance commenced, and 15th November 1942, by which time the wing was established at El Gazala, No. 450 had moved between 300 and 400 miles, and the aircraft had operated from six different landing grounds.

The medical receiving stations were almost as mobile as the squadrons. At the opening of the campaign it had been arranged that Nos. 21 and 24 M.R.S's, the mobile medical units for the Western Desert air force, were to leap-frog forward as the advance proceeded. However, after some preliminary jockeying at the start No. 21 M.R.S. took the lead and kept it. After each move it established itself closer to the forward airfield until finally it was sited within a mile of the perimeter. On arrival at a new site only about a dozen beds would be set up, although more than 100 could be provided if this became necessary, which it never did. The best performance of No. 21 M.R.S. was to pack up early one morning, travel 100 miles, and open for the reception of patients the same night.


MEDITERRANEAN SEA
CYRENAICA
EGYPT
GULF OF SIRTE
Benghazi
El Abiar
BENINA
GOT ES SULTAN
Charruba
Barce
BARCE
MARAUA
Chaulan
Jebel Achdar
Derna
DERNA
Giovanni Berta
Wadi Tamet
MARTUBA
TMIMI
Tobruk
SIDI MAHMUD
GAZALA
EL GUBBI
EL ADEM
GAMBUT
Mechili
Sceleidima
Msus
Beda Fomm
Antelat
Agedabia
Marsa Brega
Agheila
Bir Hacheim
Bir el Gubi
Sidi Azeiz
Capuzzo
Bardia
GULF of SALUM
Bud Bud
Salum
Sidi Barrani
El Maktila
SIDI BARRANI
Tummar
LGE-79
Nibeiwa
Sofafi
Rabia
BIR MALLA
Mersa Matruh
MERSA MATRUH
LGE-74
GERAWLA
QASABA
SIDI HANEISH
(LGE-120)
MAATEN BAGUSH
FUKA
DABA
El Alamein
EL HAMMAM
BURG EL ARAB
AMIRIYA
ABOUKIR
MARYUT
Alexandria
L. Maryut
Giarabub
Siwa
QATTARA DEPRESSION
MILES 40 20 0 40 80 120 160 MILES
CONIC PROJECTION
HUGH W. GROSER
19° 20° 21° 22° 23° 24° 25° 26° 27° 28° 29° 30°
34° 33° 32° 31° 30° 29°

With the M.R.S's were surgical and medical specialists, and three or four medical officers for general work. There was a complete mobile X-ray truck, and facilities for simple pathological investigations. The forward M.R.S. also kept an advanced store of expendable medical supplies, and as it was invariably sited very close to the forward landing ground, the squadrons had no difficulty in replenishing their stores.

The Senior Medical Officer, a squadron leader at wing headquarters, supervised the medical work. He attended to most of the administrative details, and usually went forward with the advanced party of wing headquarters to arrange medical liaison with the army and medical receiving stations in newly-captured areas. He was also responsible for the purity of the water-supply, and usually did preliminary water testing, and gave instructions to the squadrons as to chlorination.

With each squadron there was a medical officer, who had the assistance of one N.C.O. and two or three other nursing orderlies. This meant that for the 1,700 men of the wing there were six medical officers. Owing to the terrain, the degree of mobility necessary and the general nature of the campaign, there seemed no way of avoiding this apparent waste.

An Air Ministry Directive, issued just before the battle of El Alamein, instructed that each squadron medical officer should be supplied with a 3-ton truck, on which he was expected to build a mobile dressing station. No special materials were allotted and it was left to the ingenuity of the individual officer to contrive his own structure. Timber was short, but by "scrounging" and with the aid of a variety of materials, including packing cases and parts of wrecked aircraft, the mobile dressing stations were completed, and proved a great success. A small trailer had originally been used by No. 450 Squadron for this purpose. Trailers, however, proved most unsatisfactory in rough country, and were continually breaking down. This one was, therefore, taken off its wheels and mounted on the 3-ton truck, to which it was secured by bolts. The squadron carpenter then added extensions until the whole truck was built over. Perspex was used for windows, and a door added. The whole was covered by a tarpaulin, and proved reasonably dust and weather-proof. The interior was fitted with a metal basin and with cupboards and shelves. As far as possible, bottles containing drugs, lotions and other *materia medica* were standardised and fitted into racks, which kept them immobile during transit, and containers of sterile dressings, bandages and other articles in frequent use, were fastened to the benches. The back flap of the truck made a convenient platform, and entry was effected by means of a light metal ladder attached to the flap. Waiting patients used the medical panniers as seats.

A large Ford 6-wheeled ambulance was also allotted to each medical officer.

The amount of medical work that was done by the squadron medical officer was small. Sick parades usually amounted to no more than two or three from a total squadron strength of 300, and when the squadron was busy operationally the sick parade disappeared entirely. There were

a few cases of infective hepatitis, but coughs and colds were practically non-existent, and even the desert sore was absent. The excellent general health of the squadron was no doubt due in a large degree to the fact that the campaign was fought mostly in the winter, a healthy time in the desert, with frosty nights and crisp days of bright sunshine. Flies were then at their minimum, though with any slackening of the hygiene organisation, they tended to increase rapidly.

The only casualties due to enemy action on the ground were caused by mines, either anti-personnel or anti-vehicle, and by booby traps. Very few were caught by the booby traps, as warnings were dinned into all ranks, but a number of men in the wing were killed or injured by anti-personnel and anti-vehicle mines. Allied supremacy in the air at this stage was such that there were no strafing attacks. It was occasionally necessary to apply first-aid treatment to wounded members of medium-bomber crews. Their aircraft were operating from landing grounds farther back; but if any member of the crew was wounded over the target, it was the practice to land on the forward airfields to seek medical aid. After first-aid treatment, such patients were evacuated to the nearest M.R.S., or to an army dressing station.

The squadron's own pilots if wounded while in the air did not usually return to their unit for treatment, as they were either shot down and killed, or captured, or else made crash landings beside the nearest unit flying the Red Cross on their own side of the lines. Crash landings were, of course, comparatively easy owing to the generally flat and open nature of the terrain. There were no burns casualties within the squadron, although some other units were less fortunate. At first many pilots flew in short-sleeved shirts and shorts when the weather was warm but the medical officer recommended to the commanding officer that this practice should be forbidden because of the possible danger of burns. An instruction was immediately issued that pilots while flying should wear trousers and long-sleeved shirts, or flying jackets. A further recommendation was that pilots should wear ordinary airmen's issue boots when in the air. Several pilots who had been shot down and walked back, arrived at the squadron with their feet in very poor shape, as a result of walking in light shoes, or wool-lined flying-boots. One pilot lost his flying-boots in a quicksand and came back in his socks, with scraps of parachute material bound round his feet.

The medical officer controlled a hygiene section consisting of a corporal and three or four general hands. The hygiene corporal had the use of a 3-ton truck, which carried all the material necessary for his duties —bucket-type latrines, drums of water, spades, pickaxes, disinfectants and spare refuse bins. The latrines were fitted with fly-proof seats and automatically closing lids, and were most efficient. They were issued on the basis of 12 per squadron, that is, one to every 25 men. This, although adequate for personnel living in barracks, was not necessarily so for squadrons dispersed over an area of half a mile or more. Forty-gallon drums with fly-proof lids were used for kitchens and mess refuse. The

principal difficulties in dealing with them arose from carelessness and rough handling by kitchen and mess staffs. Lids were knocked out of shape, and needed constant repair to ensure good fitting. Kitchen staffs were also apt to leave the lids off, or even to lose the drums altogether. Hence the necessity for carrying spares.

The hygiene section's chief duty was the disposal of refuse. It was not practicable to dig either shallow or deep-trench latrines owing to considerations of time and the shallowness of the soil in the neighbourhood of most desert landing grounds. So the refuse was buried daily at a distance of at least a mile from the camp in some convenient wadi where the soil was usually many feet deep. There was a continual battle of wits between the hygiene corporal and the Arabs. Although an airfield might be situated in the wastes of the desert with no Arabs visible, there were usually some in the neighbourhood, and they kept up an unbroken watch on the movements of the hygiene squad with the object of digging up the refuse to search for unconsidered trifles.

After burial of refuse, the containers were scoured with water, sand and disinfectants. It is interesting to note that, although R.A.A.F. landing grounds were almost completely free from flies—that is to say landing grounds that the R.A.A.F. had constructed and occupied—those that had been in occupation by the Germans for some time, were invariably very dirty and swarming with flies—an unexpected failure in hygiene on the part of the German Air Force.

Every truck carried a number of excellent German petrol cans (known as "Jerry cans") and these were filled with water whenever an opportunity offered, and carried for emergency use. The Jerry can was strong, well designed for carriage and stowage, rust-proof and leak-proof. It was, in fact, one of the finest pieces of functional equipment encountered during the war. Notwithstanding, there was always a shortage of water and there were times when the allowance was one water-bottle per man per day, half of which was given to the kitchen. One small mug of water was used to clean the teeth, shave and rub the body all over. This was not very effective as a cleansing method, but at least it was refreshing, and none seemed to suffer any ill-effects from the continual state of dirt. The squadron medical officer did not have a really good bath for five months, and this was the general experience. Although washing had to be minimal there was always adequate water for drinking. The medical section was allowed an extra five gallons a day.

Food, on the whole, was dull, as of necessity it had to be. Practically everything was tinned, and there was the inevitable dreary alternation of bully beef and M. & V. (tinned meat and vegetables). These items were prepared in a variety of ways, and in various disguises, the number and variety being dependent upon the initiative of individual cooks, although bully beef, plain and cool, straight from the tin, was probably preferred to bully beef in any other form. Potatoes were canned and not particularly palatable, but with a type of sausage prepared mainly from soya bean the men considered that they really plumbed the depths. Even

hungry men could eat them only when mixed with other more highly flavoured food, and copiously camouflaged with Worcester sauce, which fortunately was usually available. There was plenty of excellent cheese and army biscuits. The latter were a useful stand-by, and when oatmeal was not available could be soaked and made into porridge. Bread was rarely seen, and margarine replaced butter. There was ample sugar, tea and powdered milk.

The Arabs were usually able to provide a few eggs. Whence they came was a mystery, as no fowls were seen, but there the eggs were, and they could be obtained in exchange for tea, of which the Arabs were particularly fond. Powdered egg and canned bacon were supplied as part of the ration issue. In Cyrenaica it was possible to procure fresh vegetables in the small Italian farm settlements. It was also possible, occasionally, to shoot a few gazelle, and the fresh meat, though somewhat tough, and of necessity eaten too fresh, was most welcome. Apart from gazelle, No. 450 had fresh meat on only two occasions between its departure from Alamein and its arrival at Medenine in Tunisia.

Australian Comforts Fund parcels and private parcels were frequent, the most popular individual article they contained being the fruit cake. In the pilots' mess, these fruit cakes were treated as common property and were placed on the bar counter, any member being at liberty to help himself.

There was a plentiful supply of vitamin tablets, and no cases of illness occurred that could be definitely attributed to vitamin deficiency, with the possible exception of one case of gingivitis.

The pilots' mess was housed in two large E.P.I.P. tents, and normally accommodated about thirty-five. It was furnished with a collection of folding chairs, forms, and collapsible trestle tables. At one end, there was a bar, the counter of which was made from the tail-plane of an Me-110, supported on two 40-gallon drums, its front draped with a large swastika flag, captured at El Daba. Packing cases were used for seats. The sergeants' mess, with a membership of about ten, consisted of one E.P.I.P. tent.

The officers, other pilots, and ground-staff sergeants lived in oblong tents, four to six men in each. Each man had a camp bed. The airmen were accommodated in mosquito-and-fly-proof one-man bivouac tents. These were invariably "dug in", that is to say, a slit trench sufficient to accommodate bedding (groundsheet and blankets) was dug, with a shelf to carry a small amount of personal kit, and the tent pitched over it. It was a rule that tents should be pitched 150 to 200 yards apart. Bivouac tents could be pitched in groups of four. These arrangements were necessary to reduce the risk of casualties during bombing, and even, on occasions, shelling. The airmen, who were seasoned campaigners, contrived to make themselves quite comfortable in their small tents, which were frequently furnished with wireless sets, and other amenities picked up in their travels.

Throughout the campaign morale remained high. This was not surprising when it is remembered that the squadrons were always on the

winning side and pursuing a beaten enemy, who could do no more than fight delaying actions at various points, but the following observations on morale may be of some interest:

An experienced squadron medical officer once remarked that, in his opinion, the three most important factors in its maintenance were—"mail, grog, and leave, in that order". Mail was regular. It came in large batches, about once every four weeks, containing letters and parcels posted in Australia four to eight weeks before. Often there were driblets of mail in between times. There was no doubt that the arrival of a large mail had a revivifying effect on all. The increased cheerfulness of the atmosphere was obvious. Supplies of "grog" were intermittent. Most of the pilots, being young, would have drunk beer in preference to spirits, but as the lines of communication lengthened, it became increasingly difficult to get the bulkier forms of alcoholic drinks, and after a time, only spirits, generally whisky and gin, were available. These, of course, were denied to the airmen, who officially were supposed to drink only beer. If, by any chance, a cargo of beer arrived with the spirits for the pilots' mess, it was handed over to the airmen. From time to time, special issues of beer were also available for airmen through the Air Stores Park, which followed close on the heels of the squadrons during the advance. The issue was usually two bottles. The effect on the spirits of the airmen was most marked, and the lately-consumed two bottles of beer formed a topic of cheerful conversation and reminiscence for days to come.

In the pilots' mess, drinking in the day-time was not indulged in. There is no doubt, however, that a few drinks in the evening, especially after a hard day, were very beneficial to the spirits and contentment of all concerned. What was available was rationed, the usual ration being a maximum of three drinks per night.

At times, when the squadrons passed through relatively populous areas, such as Tripolitania, it was possible to get large supplies of the local red wine. It was of poor quality, of the Chianti type, rough and harsh flavoured. In Tripoli an undamaged German brewery was found; its return to full working order was eagerly awaited by the entire Eighth Army and Desert Air Force. After a week or so it was possible to issue a few bottles to each man and soon supplies became available fairly regularly.

Squadron medical officers were placed in charge of the rum issue and were given authority to draw it from the army dumps at the rate of an ounce a man for a single issue. Most drew their full quota on every possible occasion, and thus maintained a store in the medical section, which could be issued on suitable occasions. At the end of a long convoy when camp had to be pitched in the dark and often wet, and with only a cold meal available, the effect of the issue of an ounce of service rum to each man in the squadron was spectacular.

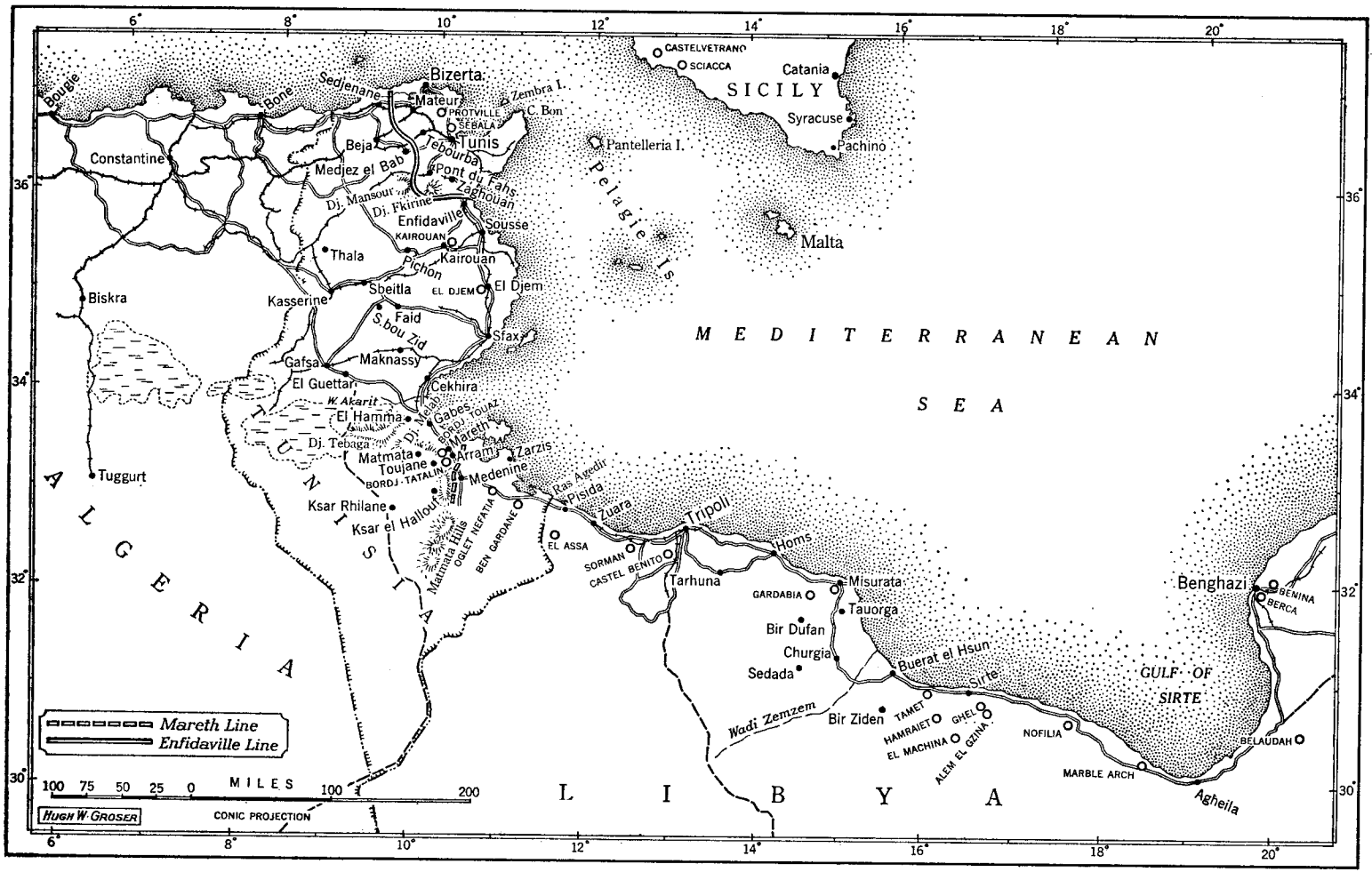
Leave was always something of a problem, especially as the fighting drew farther away from Egypt. For the pilots it was possible to provide air transport during quiet times in the intervals between major battles.

On these occasions they would be flown out to Egypt in batches for four to five days' leave. There was no routine in this matter, but opportunities were taken for leave as and when they arose. Alexandria was more popular than Cairo as a leave city. For one thing, it was much cleaner, and there was a good sea breeze blowing through it all the time, and, for another, there was a general belief that the Alexandrines were more honest than the Cairenes. Much of the leave period of the pilots seemed to be spent in shopping for their friends, particularly for the ground staff, who did not have the same opportunities. These brief breaks from duty were looked forward to with great keenness, but the pilots usually seemed happy to be back with the squadron.

For the ground staff, who worked very hard to maintain the aircraft, such breaks were impossible, because of transport difficulties, and some of them spent up to twelve months on the squadron without a leave of reasonable length. It had been the practice during previous campaigns to maintain a holiday camp on the beach, to which ground staff were sent for a few days at a time to fish and swim. During this campaign the squadrons were usually situated a long way from the sea, towards the left flank of the army. However, whenever there was a few days' halt in the neighbourhood of any interesting place, such as often happened in Cyrenaica and Tripolitania, ground staff were sent off in batches of one-third of the squadron strength to see the sights, and if possible, to do a little shopping or "scrounging".

The army close-support squadrons were still treated as fighter squadrons from the point of view of the operational tour for pilots, and a full tour was considered to be 200 hours' operational flying. This seemed reasonable for squadrons engaged in purely fighter work, especially at this time when the Allies had air superiority. The Kittyhawk squadrons did very little pure fighter work at this stage, and most of their operational sorties involved dive bombing and ground strafing. They also did a great deal of medium-bomber escort. In this type of work they were at a disadvantage in that their prime duty was the protection of the bombers, with their own safety a secondary consideration. In the low-level sorties, although they might not meet much opposition from the air, they were the targets of heavy and accurate ground fire. Individual pilots usually did one sortie a day, and often two or more, and on practically every occasion, they were in actual contact with the enemy. The medical officers of such squadrons believed that a tour of 200 hours was rather too long for the average pilot, and they made known their views to the Principal Medical Officer. No official alteration was made in the length of tours, but wide discretion was given to the squadron commander and his medical officer. In most cases the medical officer of No. 450 recommended the termination of a pilot's tour at about the 150-hour mark, and other squadron medical officers did likewise.

On No. 450 the commanding officer and medical officer shared a tent. They had the various pilots constantly under discussion, and usually were in full agreement as to the point at which a tour should be terminated.


Bougie
Bone
Sedjenane
Bizerta
Mateur
PROTVILLE
SEBALA
Zembra I.
C. Bon
Tunis
Beja
Tebourba
Medjez el Bab
Pont du Fahs
Zaghouan
Dj. Mansour
Dj. Fkirine
Enfidaville
Sousse
KAIROUAN
Kairouan
Pichon
EL DJEM
El Djem
Sfax
Thala
Constantine
Biskra
Kasserine
Sbeitla
Faid
S.bou Zid
Gafsa
Maknassy
El Guettar
Cekhira
W. Akarit
El Hamma
Gabes
BORDJ TOUAT
Mareth
Arram
Zarzis
Dj. Melab
Dj. Tebaga
Matmata
Toujane
BORDJ TATALIN
Medenine
Ras Agedir
Pisida
Zuara
Tripoli
Tuggurt
Ksar Rhilane
Ksar el Hallouf
Matmata Hills
DJEBET NEFATIA
BEN GARDANE
EL ASSA
SORMAN
CASTEL BENITO
Homs
Tarhuna
Misurata
GARDABIA
Tauorga
Benghazi
BENINA
BERCA
Bir Dufan
Churgia
Sedada
Buerat el Hsun
Sirte
GULF OF SIRTE
Wadi Zemzem
Bir Ziden
TAMET
HAMRAIET
GHEL
EL MACHINA
ALEM EL GZINA
NOFILIA
BELAUDAH
MARBLE ARCH
Agheila
CASTELVETRANO
SCIACCA
Catania
SICILY
Syracuse
Pachino
Pantelleria I.
Pelagie Is.
Malta
MEDITERRANEAN SEA
ALGERIA
TUNISIA
LIBYA
Mareth Line
Enfidaville Line
100 75 50 25 0 MILES 100 200
HUGH W. GROSER
CONIC PROJECTION
6° 8° 10° 12° 14° 16° 18° 20°
36° 34° 32° 30°

Moreover, the pilots themselves realised that their interests were being watched and that as soon as they showed signs of tiring they would be rested. It was sometimes the practice to break a man's tour and give him a few weeks' rest, but the medical officer was not in agreement with this. He believed that the only alternatives when a man was tiring were either to give him three or four days' leave, or terminate his tour completely, placing him on his full six months' rest period of non-operational flying, and then returning him for a second tour.

The amount of operational duty that a pilot could stand was greatly influenced by the kind of experiences undergone in the course of the tour. For example one man was put off after 80 flying hours. At this time, he was exhausted, having been shot down four times and wounded twice. After a six months' rest period, he returned to complete a second tour with the squadron and gained the D.F.C. At this stage pilots could go through an operational tour of 150 hours in about five months.

No definite period for an overseas tour was laid down for members of the ground staff. In the R.A.F. an overseas tour was four years for single men and three years for married men, and this was deemed fair enough by the Australians. What they disliked was having no time specified. It was the subject of frequent conversation and grousing, and visiting senior officers, when they addressed the men, were continually bombarded with questions on this subject.

In the same wing as No. 450 was a regular unit, No. 3 Squadron, R.A.A.F., and for a long time it was the practice of this squadron to return to Australia ground-staff men who had been overseas with the squadron for about 18 months, replacing them with new drafts from Australia. This did not improve matters with members of No. 450 Squadron, an E.A.T.S. unit. The great antidote to dissatisfaction among the ground staff was work. In busy periods grumbling was at a minimum; only in the quiet times was there much complaining.

A factor that exercised a considerable influence on the state of morale was bombing, particularly persistent bombing. Actual casualties from this cause were very few, and in No. 450 Squadron there were none at all during the period under review. As most of the bombing took place at night, an added factor was the loss of sleep. At the opening of the campaign the anti-aircraft guns usually returned fire only when it became obvious that the enemy had found their objective, but as time went on and the anti-aircraft defences increased the guns went into action whenever enemy aircraft were over the landing grounds. The effect on morale was instant and marked. Fortunately during this period enemy bombing, though fairly frequent, was never carried out by strong forces, and was seldom sustained for more than two consecutive nights.

Organised entertainment naturally enough was infrequent, but occasionally cinema shows were put on in the forward area and individual squadrons sometimes organised variety shows to which members of other squadrons were invited. They were usually excellent, and evoked great enthusiasm.

In No. 450 Squadron, singing was a popular evening's amusement in the pilots' mess. There was a Scottish R.A.F. officer with an excellent voice and a vast repertoire of songs (not obscene) suitable for group singing. The Scot was supported by an R.A.A.F. sergeant pilot. The sergeant pilot performed on the ukulele, was a professional writer, and composed a number of topical verses, which were set to popular tunes, notably "Lili Marlene", and in the course of time became squadron songs. Later the squadron secured (in somewhat dubious fashion) a piano. In spite of transport difficulties this was moved from place to place and ended its career in Tunis. Visitors from other squadrons joined in these musical evenings and, assisted by a few drinks, the parties were invariably a great success and definitely elevating to morale.

Almost as popular as the mess for social gatherings was the mobile dressing station. The senior nursing orderly combined efficiency with considerable social gifts and was, in fact, everybody's friend. Both pilots and ground staff were in the habit of dropping in for a cup of tea to exchange news and air grievances. The medical orderly, incidentally, was an expert barber, and he set up his hair-dressing stand beside the dressing station, even providing benches for waiting customers and a collection of illustrated periodicals for their entertainment. In this way the medical officer was made aware, unofficially, of the general state of feeling throughout the unit, and, also unofficially, he became a channel through which helpful information could be passed from the lower to the higher ranks, and in the reverse direction.

It was notorious that aircrew members were averse to taking part in any form of organised physical exercise. Any squadron medical officer misguided enough to try to introduce such activity as physical jerks was doomed to disappointment. On the other hand, any activity which pilots themselves introduced was likely to have an instantaneous and sustained success. Canadian pilots in the squadron received a set of softball equipment. This game took on at once, and in no time inter-squadron matches were being played with tremendous vigour and enthusiasm.

Pilots from many parts of the world were to be found within No. 450 Squadron. They came from the British Isles, Australia, Canada, New Zealand, South Africa and usually there was at least one American. In fact only about half of the pilots were Australians. It was interesting to note that they did not tend to coalesce into national groups, but, more often chose friends from other parts of the world. There was, of course, a certain amount of amiable rivalry between the various Dominions, which was an excellent thing. They learned to see each other's points of view, and to "rub each other's corners off". They also learned to think of one another, not as Australians or New Zealanders or Canadians, but as fellow pilots and comrades. "I believe," wrote the squadron medical officer, "that these mixed squadrons were the best and happiest, and this is an opinion that I know is shared by most people who have had personal experience of these things."

We will now leave No. 450 Squadron and turn to some of the later operations in Tunisia, Malta, Sicily and Italy as seen through the eyes of the medical officer of No. 3 Squadron, who was then Squadron Leader T. W. Jenkins.

No. 3 Squadron as part of the Desert Air Force was used in close air support of the westward advance of the Eighth Army, which culminated in the capture of Tunis on 7th May 1943. Like No. 450 Squadron, No. 3 was extremely mobile. Its medical transport consisted of a 6-wheeled, 4-berth Bedford ambulance and a captured Italian ambulance, which had been converted into a mobile treatment room. When the squadron moved the ground staff rode in trucks which usually travelled in a wing convoy but sometimes as individual squadron convoys. Land mines were a constant menace along the edges of the roads, and medical personnel and equipment were distributed at intervals throughout the convoy so that casualties could be dealt with rapidly. Fortunately casualties from mines were rare in the wing and the medical officer was called upon to deal with them only once, and once was enough as it involved entering the minefield to recover the injured. When the squadron was operating a roster of duty ambulances was made out by the S.M.O. Wing and from daylight each day one ambulance, with driver and nursing orderly, stood by with the fire tender at the edge of the airstrip until released. Crash kits, splints and plasma-giving sets were kept ready for use in the ambulance, and on the day of his ambulance's stand-by duty the squadron medical officer was expected to remain in the vicinity of the airstrip.

Besides the regular R.A.F. issue of medical equipment made to all units in the Desert Air Force, the squadron carried a full set of R.A.A.F. panniers. These, although the envy of other medical officers, were of doubtful value. Soluvac equipment in the transfusion pannier could not be replaced by the R.A.F. or by any British unit and when the bottles were sent for sterilisation they always seemed to come back with some part of the stopper missing. In any case the R.A.F. scale of issue included a plasma-giving set and there were always blood banks within easy distance. In a unit adequately serviced by mobile field hospitals the instruments in the surgical pannier were superfluous and even dangerous as they might tempt a unit medical officer to undertake surgical procedures which would be done more effectively in those hospitals. The fracture and gas panniers were never opened, and the gas pannier was duplicated by the R.A.F. The medical panniers were eventually returned to Australia, as there was never any difficulty in obtaining supplies of drugs and dressings from the mobile field hospitals.

Squadron sick-quarters did not maintain beds except in areas where the roads were very bad, patients being treated in their own quarters or admitted to the near-by wing sick-quarters or the mobile field hospital, which arranged their evacuation farther back if necessary. Towards the end of the Tunisian campaign wing sick-quarters capable of handling 20 to 40 cases were established and staffed by wing and squadron per-

sonnel. This proved very useful in Sicily where roads were narrow and badly surfaced and where the wing had a number of casualties from enemy air action, but it was never very popular with squadron commanders, who considered that it separated medical officers from the unit and especially from aircrew, and it was finally disbanded.

In the three months preceding the capture of Tripoli the squadron had a very arduous time in the desert. Water was scarce and the quality of the food poor. Water was drawn from central supply points operated by the Royal Army Service Corps. Each squadron had one water vehicle but No. 3 Squadron was fortunate in being able to acquire two German water trailers. The water was usually chlorinated at the water point and daily tests were also carried out in the unit and more chlorine added if necessary. Unhappily, detasting tablets were not available and the water was often unpalatable. Twice there were rumours that local wells had been poisoned by the retreating enemy, and the squadron, which was equipped with a Water Poisons Testing Case, carried out full tests. In both cases these were negative. As a result of the difficult conditions there were a number of cases of skin disease and occasional mild outbreaks of diarrhoea, but these cleared up rapidly once the squadron entered Tripoli and living conditions improved. From then on sick parades were uniformly small, averaging about 10 a day from some 250 men. Regular "F.F.I." parades were also held, and a few cases of louse infestation and scabies were detected. It was matter for some astonishment to the R.A.F. medical officers that the Australians did not try to dodge these parades but actually seemed to welcome them.

In preparation for its proposed role in Sicily a "weeding out" process was undertaken in No. 3 Squadron, and a number of airmen who were technically still medically fit for overseas service but whose general health was below par or who were constantly on sick parade were sent back to rear areas. When the landing in Sicily was made on 10th July the squadron which had moved to Malta the previous day began offensive sorties against enemy traffic on the roads behind the battle-front, and on 16th July it moved to Sicily. For the purpose of the landing 3-ton trucks had been converted into emergency ambulances and the motors water-proofed as it was anticipated that they would be landed at a beachhead, although as it happened they were disembarked on to a wharf at Syracuse. The squadron's new base was Pachino airfield, a low-lying and unhealthy spot, but with its vineyards, olive groves, fresh fruit, vegetables and eggs, still a welcome contrast to North Africa. On one occasion at Pachino the medical officer of No. 3 Squadron supervised a large-scale air evacuation of sick and wounded. A marquee was erected at one end of the airstrip in which patients were held and cared for while awaiting evacuation, and within a few days 600 of them were taken out by aircraft of No. 1 Air Ambulance Unit, R.A.A.F., a South African Air Ambulance unit and by R.A.F. Transport Command. One DH-86 of the Australian Air Ambulance Unit, filled with lying cases, caught fire while taxiing out to take off, and was completely destroyed in a few

minutes. Owing mainly to the efforts of the captain all patients and the crew escaped without injury.

In Malta pilots had been billeted in a hotel, which they found very pleasant as squadron personnel normally slept under canvas. It was rare, however, to see a member of the squadron, whatever his rank, sleeping on the ground. All kinds of furniture appeared, from camp stretchers to an occasional double bed complete with mattress and counterpane, and airmen were never questioned closely as to their origin. Up to the limit of the capacity of the transport they were also permitted to carry some chairs, floor coverings and similar furnishings for their tent, so that in the coldest part of the Italian winter living conditions for everyone were moderately comfortable.

In Sicily venereal diseases were prevalent, and the squadron had several cases, including one primary chancre. There were also several cases of malaria, but the incidence was less than for any other unit in the same area, possibly because the men had been lectured on the subject several times and made aware of the precautions that should be taken.

The squadron was fortunate in having only light casualties both among aircrew and ground staff. During the year under review two officers and some six airmen pilots were killed on operations, and three pilots returned with minor wounds, including one with a broken nose sustained in a parachute descent. Among the ground staff, there were three deaths, all resulting from petrol burns. In the absence of other fuel, petrol was freely used for cooking and heating water, and men tended to become very reckless in its use. Another member of the ground staff was injured when the squadron's airstrip was heavily bombed in a night raid.

Generally speaking morale was high. Tours consisted of 200 hours' operational flying, after which pilots were posted to a training or resting unit. Usually there was plenty of action, and as was common under such conditions there were few complaints. After the Tunisian campaign ended, however, the squadron went back almost to Tripoli; for six weeks or so there was no operational flying, and during this period the pilots tended to become jaded and a little difficult to handle. The commander sent as many of them as possible on leave and with the resumption of offensive flying, conditions returned immediately to normal. Occasionally a pilot would begin to show signs of operational fatigue. On reporting such cases the medical officer invariably received the fullest cooperation from the commanding officer and the flight commanders, and the pilot was usually either sent on leave or made "tour expired" forthwith. There were no cases of "lack of moral fibre" during the period.

INDIA AND BURMA

There were no Australian squadrons in India or Burma and the Australians in the theatre were distributed among R.A.F. squadrons. All were aircrew except for about 60 officers of the Administrative and Special Duties Branch. All medical service to Australians was given by the

R.A.F. Medical Service in conjunction with the R.A.M.C. In early 1943 the army treated serious illnesses, but by 1945 the R.A.F. had many major medical establishments in the Command. An R.A.A.F. Medical Liaison Officer, attached to the R.A.A.F. Liaison Office in Delhi, was the only Australian medical officer in India. Squadron Leader K. E. Rex, who arrived in Delhi to take up his duties on 18th March 1943 was the first liaison officer appointed; he was succeeded by Squadron Leader T. W. Jenkins on 3rd January 1945.

A close liaison had to be maintained with the Principal Medical Officer's branch, since, as already mentioned, there were certain differences between the medical policies of the R.A.A.F. and the R.A.F. The R.A.A.F. Liaison Office had every possible assistance from the P.M.O., who from time to time agreed to issue orders designed to meet the special needs of the R.A.A.F. Contact was also maintained with the D.P.M.O. (Hygiene) and D.P.M.O. (Flying) on matters coming within their provinces. The P.M.O. permitted the Medical Liaison Officer to scrutinise and take copies of medical board proceedings and this enabled him to give Overseas Headquarters advanced information on many occasions when repatriation on medical grounds was being considered.

Because members of the R.A.A.F. were widely distributed among R.A.F. squadrons, a good deal of travelling by the Medical Liaison Officer was necessary but the men appreciated the fact that an interest was being taken in them from a medical point of view. All units in India, Burma, Ceylon and Assam, on which R.A.A.F. personnel were serving, were visited at least once by a Medical Liaison Officer.

Inevitably there was delay in repatriating some invalids, due partly to lack of shipping and partly to the necessity of obtaining executive reports and the proper authorisation from the Air Ministry. The cases presenting the greatest problem were those where an aircrew member was permanently down-graded to A2B or A4B. Strictly speaking such members were still fit for limited flying and ground duties respectively in the Command, but there were so few opportunities for such work that it was the policy of the Liaison Office to apply for their repatriation to Australia. Occasionally there was a delay of some months before the Air Ministry's approval for such repatriations came through, but as these were not medical cases in the clinical sense, their disabilities being solely connected with flying, no great harm was done. The sick and injured repatriates were dealt with more rapidly. Any member found permanently unfit for all duties, or assessed as temporarily unfit for six months or more, could be repatriated without reference to the Air Ministry.

In general, the sick rate for R.A.A.F. personnel was in the region of 6 per cent per month—a high figure, but understandable when the number and variety of endemic and epidemic diseases in the theatre were taken into account. The main causes of non-effectiveness were malaria, dysentery and infective hepatitis. Venereal diseases were also rather prevalent. The following figures represent the average incidence per month of the diseases mentioned for a period in 1943-45:

	Average per 1,000 per month
Malaria	9.24
Amoebic dysentery . .	2.32
Bacillary dysentery . .	2.76
Infective hepatitis . .	4.12
Enteritis	4.68
Venereal disease . . .	3.48

Of the cases of venereal disease, there were 16 penile sores and 65 cases of urethritis, and one double infection (gonorrhoea and syphilis). Eleven of the 65 cases of urethritis were shown in the records as non-specific.

A total of 1,887 R.A.A.F. personnel served in the Command. The average monthly strength over the 26 months given above was 904. Total admissions to hospital over the same period were 1,371, a monthly average of 52.73 per 1,000 per month. Compared with sickness rates in Australia and New Guinea this was a very high figure, and in view of the possibility that many of these diseases would have after-effects which would give rise to pension applications, the importance of keeping complete medical records was obvious.

CHAPTER 25

IN THE SOUTH-WEST PACIFIC—FIRST PHASE

IN the two years before December 1941 the possibility of war in the Pacific was anticipated. Bases to the north of Australia were reinforced on a modest scale with air force and army units, and advanced operational bases were established by the R.A.A.F. at Millingimbi, Horn Island and Groote Eylandt, at harbours in the Solomons, the New Hebrides and the Santa Cruz groups of islands, and at Laha on Ambon and Koepang in Timor. The air force units at these bases were administered by Northern Area with headquarters at Townsville. Squadron Leader C. J. N. Leleu was the Principal Medical Officer, and his staff included a hygiene officer, Pilot Officer H. L. Taylor, and two nursing orderlies.

The preparations on Ambon and Timor were made in fulfilment of an agreement with the Dutch that Australia would reinforce these islands if war with Japan became an immediate threat. Thus in December 1941 flights of Nos. 13 and 2 Squadrons, equipped with Hudsons, were sent to Ambon and Timor. Their main duty was reconnaissance, and, so that this might be extended, a few aircraft from each squadron were sent to Namlea on Buru Island, some 80 miles west of Ambon, where an airstrip had been laid down. Ground defence was undertaken by small A.I.F. detachments—Gull Force on Ambon and Sparrow Force in Timor.

The medical officer of No. 13 Squadron at Laha was Flight Lieutenant E. J. Davies. He provided medical treatment not only for the air force but for the men of two A.I.F. companies detailed for defence of the airstrip and for the native labourers employed on it. A building in the camp was converted into a sick-quarters and the mildly ill were nursed there. More serious cases were transferred to the Dutch military hospital at Ambon, where blood films and other specimens were also sent for examination.

There was a good deal of malaria. The airstrip was situated across the bay from Ambon town, on the only piece of flat ground available, and in an area known to be hyperendemic for malaria, particularly the sub-tertian type. The army suffered more severely than the air force, as army personnel, for some reason, were forbidden to take more than 5 grains of quinine daily, whereas the prescribed dosage for the air force was 10 grains. Venereal diseases were prevalent in the town, and two men were found to have *lymphogranuloma venereum,* subsequently confirmed by a Frei test. There was a good deal of dengue, and the fear of typhoid was always present. All drinking water came from a stream flowing down from the hills, which was contaminated by sewage from native villages on its banks. Water was boiled in petrol drums, but as it was usually lukewarm and the water in the stream cool and apparently pure, it was difficult to persuade the men to drink the boiled water. Purifying tablets were available but not in adequate quantities. At the

end of December there was an outbreak of bacillary dysentery. Davies himself fell a victim, and Flight Lieutenant T. W. Jenkins, who had had pre-war experience of tropical medicine in New Guinea, was sent up to relieve him. When Davies recovered he went, on his own initiative, to Namlea, where previously one nursing orderly, with the help of the Dutch medical authorities, had provided medical attention for the air force.

A minefield had been laid in the bay separating Laha from Ambon and, although a navy cutter made the crossing twice daily, Jenkins was thrown a good deal on his own resources. Unfortunately little medical equipment was available. When Davies left he had taken the medical panniers with him and, while the Dutch were most helpful in providing drugs and dressings, they could not supply any surgical instruments, and on one occasion Jenkins had to open a large popliteal abscess with a sharpened nail file and without an anaesthetic.

Food at first consisted of ordinary army rations. Jenkins authorised the local purchase of supplements such as cornflakes, condensed milk, cocoa and fruit juices; aircrew going forth on missions, who had previously been issued only with iron rations and tea, could now be given fruit juices as well, and a palatable breakfast was always awaiting them on return.

Conditions at Namlea were better. Water was laid on to the camp, making it easier to maintain a reasonable standard of hygiene, and the diet by comparison was good; instead of powdered milk and bully beef, there was goat's milk, fresh eggs and chicken.

Flight Lieutenant J. A. Horan was the medical officer at Koepang. His problems were much the same as Jenkins'. He had to care for about 250 soldiers who formed the aerodrome guard, and he set up a hut as a temporary sick-quarters, which in case of an enemy attack was intended to act also as a dressing station. The hygiene position was unsatisfactory, and malaria, dengue and dysentery were rife; there was also a good deal of dermatitis. Blood tests taken of 525 natives working in the camp showed 32 per cent positive malaria and, while there were no swamps immediately adjacent to the camp, there were some about a mile away. Flies were the causative factor of the dysentery. Fly-proofing of kitchen and mess was obviously necessary, but the considerable quantity of netting required to do the job could not be obtained locally. Horan, too, was short of medical equipment; reserves of the surgical pannier were not held either in Darwin or Townsville, and there was some delay before one could be sent up from Laverton, the squadron's parent station.

Because of the high incidence of disease at Laha and Koepang the Hygiene Officer of Northern Area was instructed to inspect the bases and "clean them up". Taylor, with Horan's cooperation, made a start at Koepang, but never reached Laha. Before he could do so the administration of the bases was transferred from Northern to the newly-formed North-Western Area, and he was recalled to Townsville. In any case, the swift advance of the Japanese southward would have prevented him completing the task.

On the day Japan entered the war aircraft from No. 13 Squadron had bombed Tobi, and a few days later they attacked a Japanese destroyer off Ternate; in mid-December No. 2 Squadron attacked two Japanese submarines.

The Japanese retaliated on the night of 6th-7th January when flying-boats bombed Laha. In full moonlight the aircraft made four bombing runs, dropping anti-personnel bombs, and then returned to strafe the camp; but apart from one pilot on the ground who was slightly wounded by a splinter, there were no casualties. Thenceforward hostile aircraft appeared almost daily. After the first raid a Dutch medical officer who had been working near the strip moved on, leaving behind some panniers of medical and surgical equipment, and for the first time Jenkins had enough equipment to deal with surgical emergencies.

Losses in the air were heavy, and replacements did not arrive. When aircrew returned from operational flights, usually of seven hours' duration or more, they had to remain near their aircraft for the remaining daylight hours, so that they could take off and hide in the clouds in the event of air attack. Ground staff too were strained almost to breaking point as they worked to keep the aircraft serviceable. The little time that might have been given to rest was disturbed by air-raid alarms, which on most nights kept everyone in the slit trenches.

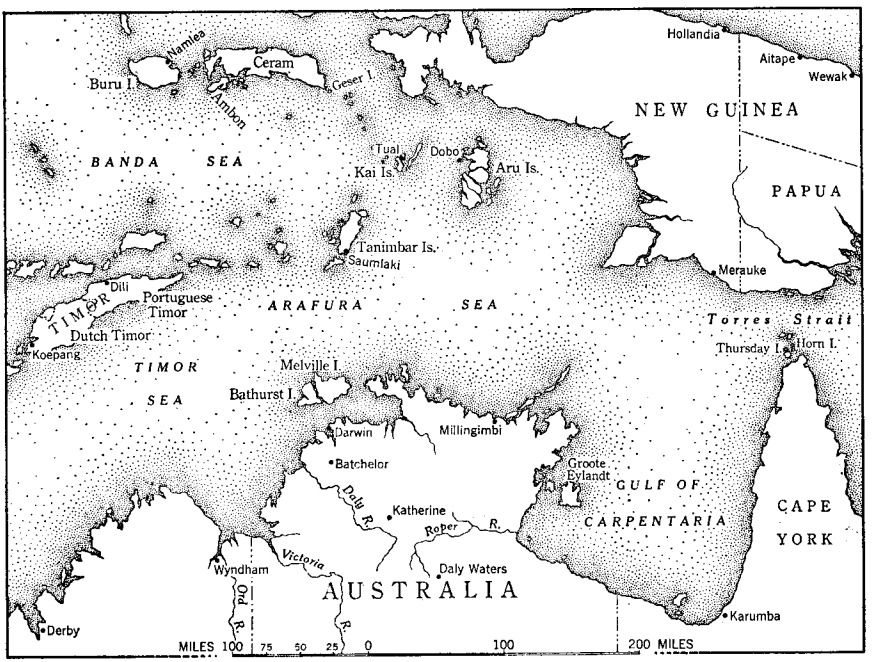
On 11th January Hudsons from Namlea shot down four Japanese float planes. On 29th January one of the Hudsons sighted a Japanese convoy steaming towards Ambon. It was realised that the position was hopeless, and the squadron was evacuated to Darwin.

Koepang had been raided by the Japanese on the 26th January and again on the 30th, a number of aircraft being destroyed on the ground. It was obviously impossible to maintain aircraft there any longer, and thereafter No. 2 Squadron based its patrols on Darwin, using Koepang only as an over-night stopping place. In the middle of February a convoy set out from Australia to reinforce Timor. On the 16th it was attacked by Japanese aircraft and forced to turn back, and on the 18th and 19th the members of No. 2 Squadron still at Koepang were withdrawn to Darwin.

The air force station at Darwin was situated on the outskirts of the town, and consisted of a large airfield with buildings specially designed for a tropical climate. They were raised on piles and built of weather-board with extensive louvres which could be opened to take advantage of any movement of air. The station sick-quarters, which were not completed, until September 1941, had an operating theatre, X-ray room, pathology laboratory, two wards and duty rooms, and were staffed by four R.A.A.F. sisters. Squadron Leader P. R. Delamothe was the senior medical officer. There were satellite aerodromes at Batchelor and Daly Waters, and although each had a small sick-quarters, no medical officer was attached at this stage.

In the dry season the area was comparatively healthy, but during the "wet", which lasted roughly from January to March, minor skin lesions

rapidly became infected, and dengue was troublesome. Dysentery was endemic and malaria a danger, particularly if carriers were allowed to enter; large numbers of susceptibles from all Services were stationed in the area; the vector, the anopheles mosquito, was present, and climatic conditions were favourable for breeding.



On 15th January 1942 control of the Darwin station passed from Northern to North-Western Area. The P.M.O. was Squadron Leader J. C. Sangster, and he was immediately alert to the possibility of malaria being introduced by men returning from Ambon and Timor, many of whom were probably infected. On the advice of army malariologists, all aircraft from the Netherlands East Indies were sprayed on arrival, although the ideal would have been for a spray gun to be issued to each aircraft so that it could be sprayed after take-off and again in the air before landing; the men disembarking were instructed to discontinue their dosage of suppressive quinine, and blood films were taken. A large number of infections was discovered, a fair proportion by blood examination. They were treated to prevent the development of clinical malaria, but the medical officer of No. 13 Squadron did not escape. Jenkins developed sub-tertian malaria early in February, and had to be admitted to hospital.

The realities of war had first been brought home to the area by American Flying Fortresses from the Philippines, which used Batchelor as a repair depot. Some arrived in a badly damaged condition, having been attacked by enemy aircraft on their way to Australia, and the sick-quarters were

kept very busy. On Christmas Day 1941 one landed with four casualties on board: two were slightly wounded and two dead.

Two months later it was Darwin which took the first blow delivered by Japan against the Australian mainland. On 19th February enemy bombers appeared with fighter cover. At the time there were four Australian squadrons in the area—No. 2 (Hudsons), No. 12 (Wirraways), No. 13 (Hudsons) and No. 34 (Transport)—but they were distributed between the airstrips at Darwin, Batchelor and Daly Waters. The first attack, which was made about 10 o'clock in the morning, was directed against the town, wharves and shipping, and the second, some two hours later, against R.A.A.F. installations. In the two raids about 250 people were killed; 8 ships were sunk and 24 aircraft lost. The air force station was largely destroyed. A sick parade was being held when the bombers came over, but although the hospital area was heavily bombed, there were no casualties. This was probably due to the accessibility of a number of slit trenches, which had been built on the advice of Flight Lieutenants Horan and Davies, who had seen their value demonstrated on Ambon and Timor. During the raid the medical staff, which then included six R.A.A.F. nursing sisters, carried on their duties in specially prepared air-raid shelters.

RABAUL

While the Hudson squadrons were making their hopeless stand at Ambon and Timor Japan had attacked another Australian base—Rabaul. In 1941 Rabaul was garrisoned by an A.I.F. battalion and supporting army units, and an advanced operational base for flying-boats was established with about 30 men. In December part of No. 24 Squadron—4 Hudsons and 10 Wirraways—arrived. The strength of No. 24 Squadron at Rabaul, aircrew and ground staff, was in the region of 100. It was commanded by Wing Commander J. M. Lerew, and the medical officer was Flight Lieutenant K. S. Harrison.

The squadron encamped at the side of Vunakanau airstrip. This was about 1,000 feet above sea level, and the temperature, though hot, was appreciably cooler than in the town. There was a second and lower airstrip, Lakunai, near Rabaul town, and to this one flight of the Wirraways was detached.

Medical conditions did not cause any concern. Malaria was fairly well controlled. The town itself was practically free of anophelines, although breeding began a few miles out, and there were some infections among the personnel of army outposts. Near the camp areas a rapid search was made for anopheline breeding places, and a few native children were palpated for enlarged spleens. No larvae were discovered and the spleen rate was found to be under 10 per cent. Servicemen were instructed to take 5 grains of quinine daily and to use mosquito nets. No further protective measures were possible. The regular dress was shorts and short-sleeved shirts, and the only repellent available was quite useless. As it

happened, the precautions taken proved to be adequate. During the seven weeks the squadron was at Rabaul only one or two men on the upper strip and a few more from Lakunai developed malaria.

A mild form of dysentery was endemic among the army troops, and nearly all of No. 24 Squadron suffered from one or more bouts of diarrhoea. No remedies were available apart from sodii sulph and bismuth tablets, and aircrew in particular found the complaint a decided inconvenience. However, only three men were confined to bed and only one had to be sent to hospital.

Harrison held sick parades in a tent erected near the Vunakanau strip. It was fortunate that the disease rate was not higher, for his medical supplies were limited to the contents of one medical pannier which he had brought with him. The air force did not have a hospital, and Harrison arranged with Major E. C. Palmer, who commanded a detachment of the 2/10th Field Ambulance, that any air force men requiring hospitalisation should be admitted to the army field hospital which had been set up in Government House on the heights behind the town.

The air force had the same rations as the army—bully beef, beans and biscuits—a monotonous diet, relieved, however, by a plentiful supply of paw paws and pineapples purchased from the natives.

Soon after arrival in the area offensive operations were begun against the Japanese. While the Wirraways patrolled at dawn and dusk, the Hudsons carried out reconnaissance and attacked enemy bases to the north. The first Japanese reconnaissance aircraft had appeared over Rabaul on 8th December. Nearly a month was to pass before the implied threat materialised. Then on 4th January twenty-two Japanese bombers came over in perfect formation, quite untroubled by two Wirraways which used all available power in an attempt to gain enough altitude to attack. The bombers did little damage to Lakunai strip, at which their attack was directed, but some natives were killed.

In subsequent air raids on Vunakanau the runway and adjacent areas were systematically bombed, aircraft on the ground were destroyed or damaged and buildings smashed. Rabaul had no radar, and the only warning of the approach of bombers was given by spotters. Most of the men appeared unaffected by the constant raids, which often caught them at a distance from one of the few slit trenches, but some of the older men developed acute anxiety symptoms and would have been evacuated had transport been available. During crises, however, they worked vigorously and uncomplainingly, their symptoms returning only when the strain was removed.

Early on 20th January the outlying spotters reported many aircraft approaching. Before long the shipping in Simpson Harbour, the battery on the heads, and the airstrips were being attacked by high-level bombers, dive bombers and fighters, about 120 aircraft being engaged. Only eight Wirraways remained serviceable, and they bravely tried to intercept. One crashed during take-off; three were shot down, two were damaged but managed to land, and another two landed undamaged. Six members of

the squadron were killed, and five injured. The injured were taken to the army hospital, and operated on that night.

The town had not been touched in the raid, but next day, the 21st, it was known that a strong enemy convoy was approaching. Air force men, with only a few rifles and pistols between them and without any training, were of little value as a ground fighting force, and R.A.A.F. Headquarters ordered their evacuation. In anticipation of a trek through the jungle, each man was provided with a small medical kit obtained from the local chemist. It included 50 quinine tablets, salt tablets, bandages and mercurochrome. Arrangements were completed for destroying installations and blowing up Lakunai airfield, and the two surviving Wirraways left for Lae. A lone Hudson remained, and it was ordered to seek out the approaching fleet and attack it. Carrying only two 50-lb bombs it set forth, but failed to make contact in the darkness, and returned to Vunakanau. That night the sick and wounded in hospital were brought out to the strip and loaded into the Hudson, which departed at first light.

On the afternoon of the 22nd all the men of the squadron were crowded into trucks and cars, and the first stage of the evacuation began. After travelling a short distance the car containing the reserve medical supplies and quinine went off the road into a valley and had to be abandoned. When they came to the Warangoi River the party left their transport and made a crossing in native canoes. Overhead were Japanese planes looking for their line of retreat, and so they had to await darkness before setting off into the jungle. They walked during the whole of that night tormented by mosquitoes and leeches, but in the morning reached their goal, a plantation on the coast at Put Put, where they found a meal waiting for them. Though it was known that tentative arrangements had been made for Empire flying-boats to take them out, at that stage it was generally believed that they would have to make their way along the south coast at least as far as Jacquinot Bay before being picked up. A lugger was available at Put Put but it could take only about one-third of the party. A long walk faced the rest. With scanty supplies of food and quinine this appeared a formidable prospect, but Leigh Vial, an Assistant District Officer, was confident that he could lead them through, if necessary to Cape Gloucester. The men selected to go in the lugger were headed by Flight Lieutenant W. D. Brookes, and included the medical officer. They sailed down the coast for 60 miles to Tol at the head of Wide Bay, and there spent a night in comparative comfort at the plantation house. In the morning a flying-boat appeared. Its normal capacity was 40, but the party now numbered about 55, being swollen by civilians and army personnel who had joined it on the way. Somehow all managed to crowd on board. Harrison was the last to embark. The native outrigger which was taking him out to the flying-boat capsized, and the tension of those already in the aircraft was increased when they saw distant specks in the sky which could have been Zeros.

It was hoped that the main body would be able to walk to Tol in three

or four days. As it happened, after walking for some 10 miles they were picked up by two flying-boats and flown to Samarai.

It is interesting to note that after the men had been exposed for one or two nights in the highly malarious area along the coast, over 50 per cent of them came down with M.T. malaria within three weeks.

PORT MORESBY

A few weeks after the outbreak of war No. 11 Squadron, with two Empire flying-boats requisitioned from Qantas, had been posted to Port Moresby, and in August 1941 a second squadron, No. 20, equipped with Catalinas, arrived. In those early days the work of the flying-boat crews was unspectacular but essential. They carried out reconnaissance, surveyed new seaplane bases, and transported stores and equipment.

Their medical needs were met by the medical staff at station headquarters. This consisted of a Senior Medical Officer, an assistant medical officer and nursing orderlies, a third medical officer being added when No. 20 Squadron arrived. The flying-boat squadrons had advanced operational bases at Kavieng, Tulagi, Rabaul, Vila and Soraken. There were about 30 men at each; a nursing orderly treated their minor illnesses and injuries and a local civilian or nearest Service doctor more serious illnesses. In an effort to make the work of the nursing orderlies more interesting they were given frequent transfers until they reached Moresby, where they remained for a longer period. Special medical kits were designed for the A.O.B's. They were on the German principle, all drugs being in powder or ampoule form to reduce weight to a minimum.

R.A.A.F. hospital accommodation at Moresby was provided by a small station sick-quarters which had an emergency operating theatre. However, only men with minor illnesses were nursed there, the more seriously ill being sent to the local European hospital, which was staffed with civilian nurses. When civilians, including the nurses, were evacuated the seriously ill were sent to the army camp hospital at Three Mile (Kila); this hospital was later transferred to a site in the hills, known as King's Hollow.

The original station sick-quarters was in a tin hut on a hill near the flying-boat base, an unfortunate site by reason of its proximity to a target area. Sick men, particularly men sick with fever, do not usually react under stress as they would when well. Some airmen, who previously had seemed quite unaffected by air raids, behaved in an extremely excitable manner when bombed while in hospital with fever. When the evacuation of civilians released a number of private houses the sick-quarters was moved into a building on the Fairfax Harbour Road well away from the airfield. The new sick-quarters had large rooms and a wide verandah, and could accommodate 28 patients without overcrowding. Electric light, running water and telephones were installed. The army continued to look after surgical cases. In the event of an emergency the intention was to

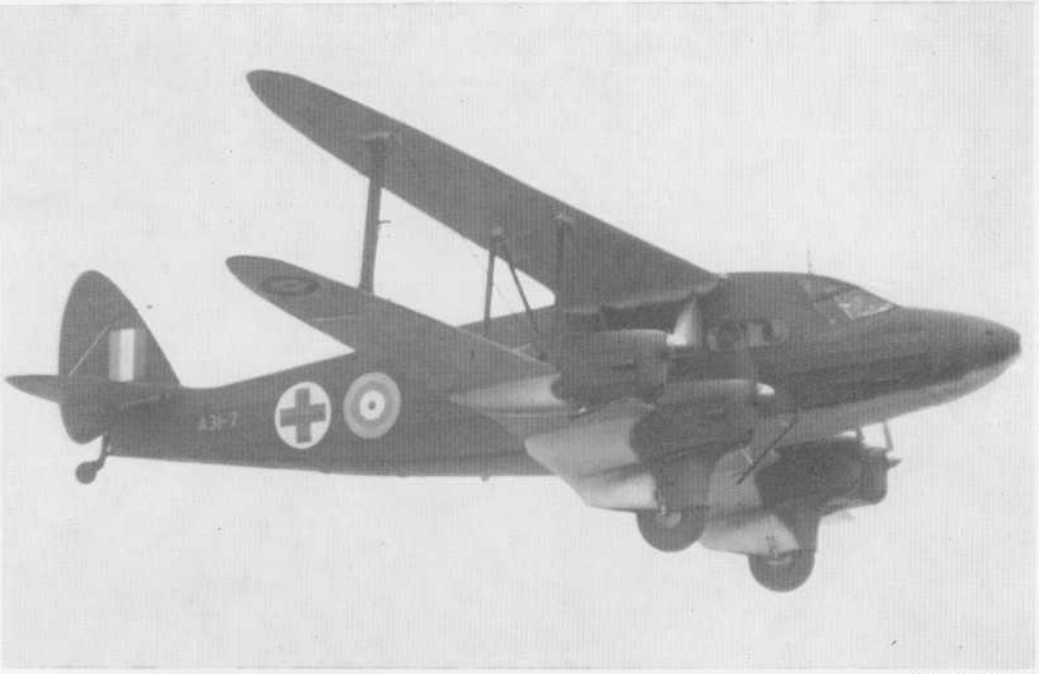
evacuate air force casualties to Townsville by air, and if this proved impossible, to the army camp hospital.

The diseases most prevalent were malaria and dysentery. In peacetime malaria control had not been pursued so competently that it continued to be effective under wartime conditions, and the Services had to take their own measures. Squadron Leader G. S. Colvin, the S.M.O. at Moresby, ordered anti-malarial drainage in the vicinity of the air force base soon after its establishment, but insufficient labour was available until about the middle of 1941 when he was given the services of a hygiene corporal and a labour force of ten natives. The corporal had graduated from the first R.A.A.F. hygiene course. The malaria rate was particularly high among the crews of Nos. 11 and 20 Squadrons, who made frequent visits to their advanced operational bases where strict anti-malarial precautions were impossible. It occasionally happened that communication between the advanced operational bases and the main base at Moresby failed and quinine and other medical supplies ran out, but in that event local purchases were permitted.

There was an outbreak of dysentery at the flying-boat base in December 1941. When Japan entered the war work on the new airfield called the "Seven Mile" (later Jackson Field) was intensified and all available labour, including natives, was diverted to the project. This made it difficult to maintain a satisfactory standard of hygiene around the base. The medical staff was required to provide labour for hygiene work but could not do so, and the result was a general breakdown in the sanitary services and a plague of flies. Later an R.A.A.F. Hygiene Section was formed and work in and around the base was begun but the section was not nearly large enough to cope with the surrounding country. Other hygiene projects were hampered by lack of material, in particular fly-wire and concrete which were required to protect kitchens and to build grease-traps and sullage pits for showers.

When Rabaul fell the two flying-boat squadrons at Moresby were for a time the last line of aerial defence barring the Japanese from the coast of Australia. Nightly they were over Rabaul, and they also raided Gasmata and Kavieng, which had now fallen to the Japanese. Early in February 1942 they were reinforced. The surviving members of No. 24 Squadron which had defended Rabaul so gallantly, fell back on Moresby, and were absorbed in what became No. 32 Squadron. Its medical officer was Flight Lieutenant A. G. McGlynn.

No. 32 Squadron encamped in wooden huts built at the side of the tarmac of the original "Five Mile" strip (later Ward's) and these were clearly visible from the air from almost any height. Soon after its arrival Japanese medium bombers began to make daily raids. Moresby had at this time no fighter protection, and as the bombers always flew at a considerable height they were not greatly troubled by anti-aircraft fire. In a raid on 24th February all the buildings in No. 32 Squadron's camp, as well as aircraft on the ground, were either destroyed or badly damaged. The squadron then moved to a tented camp under the trees in the near-by

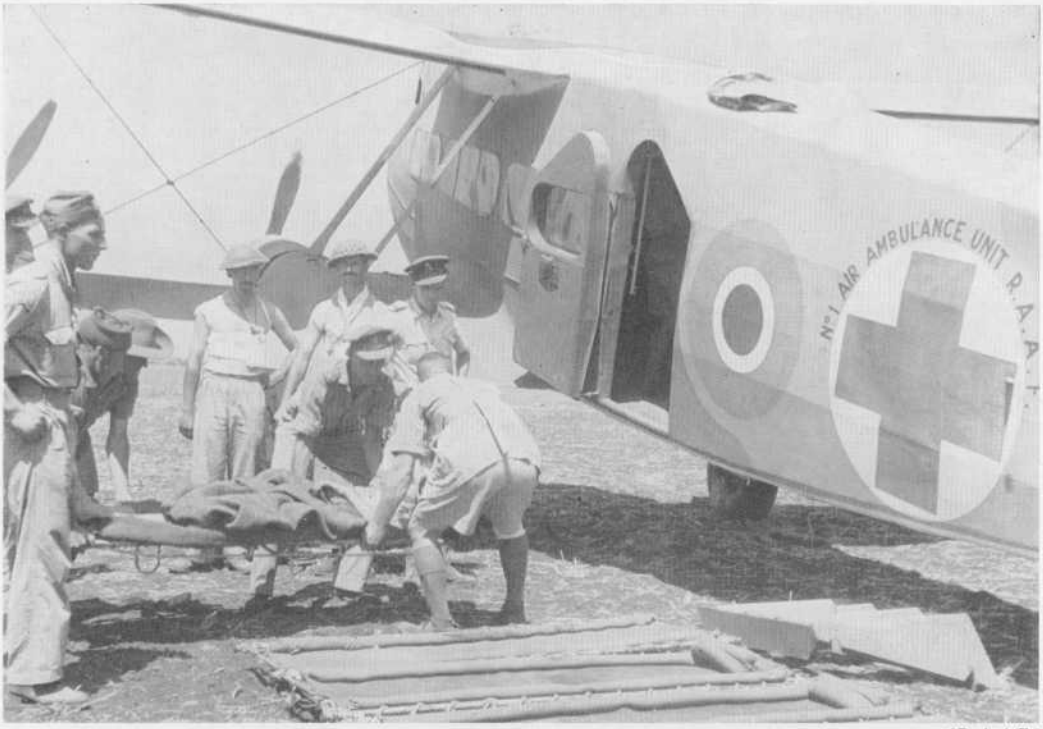


(*E. A. Daley*)

A DH-86 of No. 1 Air Ambulance Unit.



Aircraft of No. 1 Air Ambulance Unit on a desert landing ground in the Middle East.



(*R.A.A.F.*)

A patient being loaded into an aircraft of No. 1 Air Ambulance Unit in Sicily, September 1943.



(*Medical Journal of Australia*)

Interior of air ambulance aircraft, showing 6-litter configuration, cleated floor (for traction with aircraft on ground), backward-facing seat for ambulant patient or attendant on left and thermos flasks for hot food at rear.

hills. It was carefully camouflaged and care was taken to make no new tracks, particularly vehicular tracks. The new camp, which accommodated 300 men, was never directly bombed, although later it did suffer a few strafing attacks from enemy fighters. Sanitary services were well organised, and dysentery and dengue were kept under control. During the month of March enteritis was almost endemic in Moresby, but there were no cases in No. 32 Squadron. There was some malaria, however, the incidence being particularly high among the airfield guards. The field, which was situated in a low-lying, marshy area, was well over 1,000 yards long, and the guards had to patrol it at night. The majority of the malaria cases were benign tertian infections, though some quartan and malignant tertian films were recorded. The value of suppressive doses of quinine was demonstrated by the fact that many of the squadron who were symptom free while on duty in the tropics developed malaria when they ceased taking their nightly dose on their return to Australia. Two members of No. 32 Squadron were found to be allergic to quinine, developing a gross angio-neurotic oedema after their initial suppressive dose. However, they showed no allergy to atebrin and were able to carry on with that drug. Skin diseases caused some concern. The food provided was poor in vitamin content and fresh fruit was seldom procurable. Under such conditions minor cuts and abrasions quickly developed into serious lesions, despite early and thorough antiseptic treatment.

Careful medical arrangements had been made to cope with air-raid casualties. Each member of the squadron wore his identification disc, so that his blood group would be known in the event of his becoming a casualty, and each carried a sterile field dressing. The medical officer and the medical orderlies had first-aid kits, containing tourniquets, shell dressings, field dressings and acriflavine and the medical orderlies a number of morphine tubunics as well. These were invaluable. A sterile solution of morphia of known strength was immediately available for use and could be carried in a first-aid kit without fear of breakage or contamination. After a bombing attack it was McGlynn's practice to go and look for wounded. Once while the bombers were overhead he heard someone calling for a doctor. He ran to the wounded man, and was himself wounded in the leg by a piece of shrapnel. With the squadron so hard pressed, the medical officer could ill be spared and McGlynn did not report sick but continued with his duties until his leg became infected and forced him to go to hospital.

After the first raids a number of airmen came forward to complain of rather nebulous symptoms which they hoped would cause them to be boarded out of the danger area. They were mostly men of 40 or more, and from musterings which left them with too much spare time for introspection. Medical officers found it unwise to be too sympathetic, as this would have encouraged imitators. On the other hand discretion had to be used as their condition was infectious. Eventually the worse cases were evacuated south with the diagnosis of neurasthenia, and thereafter evacuations from the area from this cause were few.

In most raids the Japanese dropped an equal number of fragmentation (anti-personnel) and high-explosive bombs. The former made only a slight depression in the ground, but in a circular area of about 30 yards diameter they cleared away the grass and shrubs as if a scythe had been used, and blasted even moderate-sized trees. The penetrating power of some fragments was shown when one of these bombs exploded 30 yards from a wooden hut and a piece of shrapnel pierced the thick wooden wall, eight layers of galvanised iron stacked on the inner side, a desk in the centre of the hut, and finally the outer wall. Slit trenches provided the best protection. Each tent in the camp had a trench, which allowed a wide dispersal of personnel.

All the air-raid casualties treated by McGlynn had penetrating or lacerated wounds from fragmentation bombs received while outside a slit trench. No blast casualties were seen. In one of the early raids one member of the squadron was unable to reach a trench and lay flat on the ground as the bombs exploded around him. He received no injury from a 250-lb high-explosive bomb which fell 20 yards away, but was injured by shrapnel from an anti-personnel bomb that exploded farther away.

Several members of No. 32 Squadron reported on sick parade suffering from deafness following a raid in which they were uncomfortably close to the exploding bombs. There was, however, no apparent drum lesion, and all recovered in a matter of hours.

All wounds requiring operation after air raids were confined to the extremities or superficial layers of the body. No men with penetrating thoracic or abdominal wounds survived to undergo surgery. First aid was administered as early as possible at the site of the injury and the victim was then transferred by ambulance to the army base hospital. Should a transfusion be considered necessary a volunteer of the same blood group as the injured man would be brought along in the ambulance. Having taken measures to combat any shock that may have been suffered, the operation proceeded. The wound would be well excised, flushed with acriflavine solution and at the conclusion of the operation sulphanilamide powder would be liberally insufflated, and the edges of the wound left unapposed or only lightly sutured. After 48 hours, if convalescence had been uneventful the patient would be evacuated by air to a medical receiving station in Australia for further treatment.

The formidable flying terrain around Moresby was responsible for almost as many crashes as enemy action. It was a duty of the squadron medical officer to recover the bodies of aircrew from crashed aircraft, and sometimes this involved extreme difficulty. On one occasion a Hudson of No. 32 Squadron was sent off at night. As the men on the ground watched, it crashed into the mountainside about three miles off. A senior pilot expressed the general opinion when he said that it was impossible for the men to have survived, and that morning would be time enough to search for the plane. But McGlynn was unconvinced. Despite the risks and even seeming impossibility of getting to the site at night he and

his medical orderly, Corporal Douglas Wackett, set out at once. They found the plane burning, and the two members of the crew alive inside. Their efforts to get them out were increased when they saw that the aircraft's bomb-load was unexploded. Unfortunately, despite their efforts, the two men died the next day.

On 8th March the Japanese made landings at Lae and Salamaua. Aircraft of No. 32 Squadron attacked and obtained a direct hit on one of the transports, and thereafter they made sorties nearly every day over the two enemy bases, as well as continuing to bomb Rabaul. Almost always they were intercepted by Zeros, which with their fire power, speed and manoeuvrability had the odds heavily in their favour.

The treatment of aircrew who were wounded in these aerial battles and yet managed to return home alive followed the same lines as that for men wounded in air raids. There was, however, considerably more shock associated with their condition, as they had had to endure a flight of anything up to three hours at high altitude and in extreme cold before reaching hospital. Their chances of survival were increased by the first aid given in the aircraft by other members of the crew who had received first-aid instruction, in particular on pressure points and tourniquet application. The value of this instruction was illustrated by the fact that there were no deaths among aircrew who were wounded in the air and who were alive on returning to base, despite the often severe and extensive wounds suffered. No head, thoracic or abdominal wounds were met.

One Hudson was shot up by Zero fighters while on reconnaissance over Rabaul early in February 1942. The pilot was struck by an explosive bullet that grossly destroyed his left wrist and severed the fifth finger of his left hand. The turret gunner suffered bullet wounds of the leg, and the co-pilot had the fingers of his right hand shattered, his left radial nerve damaged giving him a wrist drop, an inch of his left tibia shot away, and bullet wounds in his right leg. When the crew had successfully fought their way out of this encounter the wireless operator, the only uninjured man on board, performed a remarkable job of first aid on the wounded, enabling the pilot to bring his bullet-riddled aircraft back to the Seven Mile and to land it with his undamaged hand, even though one wheel of the undercarriage had been shot away.

On another occasion one of the Hudsons was attacked by Zeros over Lae. The rear gunner suffered a burst in the groin, which severed the femoral artery too high for tourniquet application, and he died some time before the machine reached home. This was the only aircrew fatality ever brought back from an operational flight during the squadron's period in Moresby. Another Hudson was attacked by Zeros over Lae but the pilot evaded them and reached his base with his gunner suffering from a gunshot wound which grossly destroyed his left elbow, three bullet wounds in his left thigh, involving a multiple compound fracture of the femur, and bullet wounds in his right leg, all of which had been given expert first aid by other members of the crew.

There was an uplift of heart on the day that the first Kittyhawk fighters appeared over Moresby. On 21st March 1942 No. 75 Squadron arrived and began operating from the Seven Mile. Its commanding officer was Squadron Leader J. F. Jackson, and its medical officer Flight Lieutenant W. Deane-Butcher.

No. 75 Squadron established its camp at Bomana. No labour was available to provide hygiene facilities, and it was not surprising that there was an outbreak of enteritis. Sick-quarters had not been constructed, as there was an army main dressing station near by. Eventually this camp site had to be abandoned, and after consultation with the medical officer a new camp was erected three-quarters of a mile from the airfield. Evacuation of casualties was a matter of some difficulty, as they had to be sent to the army hospital at Rouna Falls, about 16 miles away over a very mountainous road.

On the day No. 75 Squadron arrived one of its planes shot down an enemy bomber over Moresby, and the next day the Kittyhawks set off to attack Lae. In taking off one of the machines left the runway and crashed into the scrub. Deane-Butcher, with another officer, dashed up in a utility, and succeeded in dragging the pilot from the aircraft seconds before it exploded. The attack on Lae was successful, some Japanese planes being destroyed and others damaged. Two of the Kittyhawks, however, failed to return. Hudsons from No. 32 Squadron, with American Flying Fortresses from Townsville, attacked Lae at the same time, exploding an ammunition dump and destroying or damaging a number of aircraft.

The Japanese retaliated by redoubling their raids on the Seven Mile, their bombers flying so high that it was impossible for the slow-climbing Kittyhawks to reach them. On the ground McGlynn of No. 32 Squadron was no longer alone when he searched the bomb holes for air-raid casualties. Deane-Butcher competed with him in friendly rivalry in trying to get to the victims first.

On 6th April No. 75 Squadron received the good news that one of the pilots who had failed to return from the first raid on Lae, Flying Officer W. L. Wackett, was alive and safe. This raised the spirits of aircrews, who realised that they had a reasonable chance of survival, even if shot down. Wackett had made a crash landing on the water halfway between Lae and Salamaua. Supported only by his life-jacket, a Mae West, he had had a long swim ashore, equipped with revolver, ammunition and water bottle. After landing on the beach he made his way through a mosquito and leech-infested swamp to a native village. Some of the natives wanted to hand him over to the Japanese, but two Rabaul boys rescued him, and after four days of hardship and several narrow escapes he finally managed to reach the mining township of Wau, where he met a party of the New Guinea Volunteer Rifles.

On the day news was received about Wackett the Kittyhawks raided Lae and Salamaua again. They did a good deal of damage but there were no longer sufficient of them to provide top cover, and all were hit,

one failing to reach home. Replacements of men and machines were urgently needed, but did not come. Both aircrew and ground staff were weakened by disease, in particular dysentery, and both were working under considerable strain. When the pilots were not flying or sleeping they waited, ready to take off at a moment's notice, in a tent beside the strip. Here Deane-Butcher had attempted to relieve the tense atmosphere by bringing in comfortable armchairs and other furniture which he had collected from abandoned Moresby homes. But inevitably the call would come, and the pilots would take off, flying into combat which each day became more unequal as their numbers diminished. They were approaching breaking point, and, while the job had to be done, it was often an agonising decision for the medical officer to countenance their going into action. The burden on the ground staff was almost equally great, if different in nature. They worked continuously from dawn till dusk, filling in craters which the Japanese blew in the runway so that the strip was made serviceable again soon after a raid; and patching and mending aircraft which had seemed irreparably damaged, and somehow managing to make them serviceable. In these circumstances the medical officer realised the importance of sustaining morale. He tried to make the men relax, and at night he would encourage all of them to sit around, having a few drinks and singing the squadron songs which he composed.

The week 18th to 25th April 1942 was the blackest for the squadron. Four more pilots were killed, and the commanding officer, John Jackson, failed to return from a lone reconnaissance of Lae. But while everyone was still stunned by this last blow, the good news came that Jackson was safe. He had been attacked by three Zeros, and his aircraft had caught fire and crashed in the sea. Though hampered by his oxygen tube, he managed to escape from the plane. As he swam towards the shore he was menaced by a crocodile and by the three Zeros which had shot him down, none of which, however, now attacked him. Like Wackett, he was saved by some Rabaul boys, who led him to the native village of Mapos, where members of the New Guinea Volunteer Rifles took him under their care.

On the 29th April only five Kittyhawks were serviceable and these, again led by Jackson, took off for a last attack on Lae. As they circled to gain height 25 Japanese planes came over the Owen Stanleys to meet them. Two of the Kittyhawks crash-landed, and Jackson and another pilot were shot down in flames and killed. Of its 26 aircraft No. 75 Squadron had lost all but four in six weeks.

Meanwhile Nos. 11 and 20 Squadrons too had been flying to the limit of their endurance; for several weeks the crews were in the air for 10 to 11 hours a day; one pilot who flew daily totalled 298 operational hours in a month. The Senior Medical Officer, Squadron Leader B. J. Basil-Jones, kept a close check on the log books so that he could ground men whom he considered dangerously fatigued, but fatigue could not be measured in flying hours alone. The Catalina crews worked under conditions of particular tension. Except in a narrow zone of 60 miles around

Moresby, the whole of their flying time was over enemy-occupied territory, and in their large, unwieldy aircraft they knew that, if they were seriously hit, they had little chance of getting back to base; few casualties sustained in flying-boats in aerial combat were seen at station sick-quarters in Moresby, although numbers of casualties were treated from flying-boats which the Japanese shot up in the harbour.

During March a ship had arrived in Moresby flying the R.A.A.F. ensign. This was the *Wanaka,* which had been chartered by the air force to ply between the advanced operational bases and the mainland, carrying aircraft fuel and ammunition, and evacuating the sick. The medical officer was Flight Lieutenant R. G. Mackay, and there were two medical orderlies, Flight Sergeants Bushell and Martin. On her first trip for the air force the *Wanaka* sailed from Sydney to Port Moresby. On arrival her complement, including the medical officer, set about unloading, continuing to work through the night, for they felt very uneasy about the cargo. When light came they had not got very far, and as the *Wanaka* presented a sitting target at the wharf, they began to move her. At 11.30 a.m. Japanese bombers appeared over the harbour, and watchers on the shore saw that the *Wanaka* was directly in the path of their pattern bombing. It seemed that she would surely be hit, but there was a Torres Strait pilot on board; he watched the planes through his binoculars and each time the bombs were released gave directions for the ship to alter course. Sometimes she was entirely hidden by columns of water from near misses, but when the Japanese broke off the attack she had not been touched.

By this time most of the island bases had been lost, but Tulagi remained, and the *Wanaka* was sent there to evacuate the last civilians and to land a number of coastwatchers. Soon after her departure Tulagi was occupied by a Japanese task force which then turned towards Port Moresby.

On 7th and 8th May aircraft from American carriers and the Japanese task force attacked each other's ships in the engagement known as the Battle of the Coral Sea. Although the result was not decisive, the Japanese were turned back, and the threat to Port Moresby temporarily averted.

At Moresby the atmosphere was tense before the issue of the battle was known. Station sick-quarters evacuated to the army hospital at King's Hollow all patients who were unable to walk; Nos. 11 and 20 Squadrons were sent to Cairns, and what remained of the indomitable No. 75 Squadron prepared to give battle to the Japanese fleet. When dawn broke, however, instead of the Japanese, it brought news of the Coral Sea battle.

On 30th April 26 American Airacobras had arrived at Port Moresby to relieve No. 75 Squadron, which was to return to the mainland to rearm and re-equip. The squadron's experiences at Milne Bay, which was to be its next base of operation, are described in the next chapter.

The Japanese did not relax their raids on Port Moresby. The harbour was one of their main targets, and in June they claimed a victim. This was the motor vessel *Macdhui.* On the 17th May she was hit twice by bombs but not seriously damaged. The next day the Japanese bombers came over again. *Macdhui* weaved about in an attempt to escape but this time

was set afire. Three medical officers were watching the drama from the shore. They were Flight Lieutenant J. C. Fulton, who had come to Moresby to select a site for an R.A.A.F. hospital and Flight Lieutenants J. A. Bond and A. L. Kennett.

The *Macdhui's* doctor had been killed in the attack on the day before, and the three medical officers and two medical orderlies quickly jumped into a small boat and made for the burning ship. A lifeboat which contained survivors, including the mate, loomed up out of the smoke, and as it passed the mate warned "Keep away; there's ammunition aboard". At that moment they saw a man rise to the rails and then collapse. Seriously wounded, he had been overlooked by his friends when they were leaving the ship. Without hesitation the medical party pulled over to the *Macdhui,* and Bond and an orderly climbed on board. They found the wounded man lying on the deck, unable to move. With some rope and a mattress they improvised a sling, and after what seemed like hours to the others who waited in the boat alongside, the man was hoisted over the side and into the boat. Unhappily he died next day in hospital.

New airstrips were being built at Moresby, and as they were completed American and Australian squadrons were flown in to occupy them. While the Americans were building their camps the R.A.A.F. Hygiene Section gave them service, and the station sick-quarters provided them with medical care. The sick-quarters also provided medical care for the casualties from American bombers based on the mainland, which after bombing Rabaul and other enemy strongholds used to touch down at Moresby to refuel. The newly-arrived Australian squadrons were: No. 6 (Hudsons), No. 22 (Bostons), No. 30 (Beaufighters) and No. 5 Mobile Works Squadron, with Flight Lieutenants W. D. Cunningham, H. H. Jackson, W. B. Marsh and R. E. Ashbarry as their respective medical officers. They were situated near Ward's Strip with a detachment of No. 1 Operational Training Unit which had flown up to help with the transport of supplies. No. 1 Rescue and Communications Squadron, No. 4 (Army Cooperation) and No. 33 (Transport) Squadrons were encamped near Berry Strip at the 11-mile mark out of Moresby.

The need for a field hospital in the area was becoming increasingly urgent, and during the last week of October No. 3 Medical Receiving Station under Squadron Leader Fulton moved up from Townsville and established itself next to Ward's Strip. It was ready to receive patients on the 17th November.

In September No. 9 (Operational) Group Headquarters had taken operational control of R.A.A.F. units in the area, and Squadron Leader Bond, the Senior Medical Officer at the R.A.A.F. Station, was attached as medical staff officer. Administrative work was carried out by a wing formed for the purpose, to which Bond was posted with Flight Lieutenant John Gunther, as his assistant. But the separation of administrative and operational control proved unsatisfactory, and in December the administration wing was disbanded, and No. 9 Group assumed responsibility for administration as well as operations in the New Guinea area. Squadron

Leader Fulton became the P.M.O. of No. 9 Group, and the Senior Medical Officer and the medical staff from the administration wing were transferred to No. 45 Operational Base Headquarters with responsibility for making medical arrangements for all the small static units in the area. This was more satisfactory than the previous organisation from the medical standpoint.

In January 1943 Gunther, now a squadron leader, who had had extensive experience as a malariologist in New Guinea, became deputy P.M.O. of No. 9 Group. Up to that time anti-malarial precautions had been inadequate. In the last few months of 1942 attempts had been made to obtain supplies of protective clothing, and although a small quantity of long-sleeved shirts and long trousers had arrived, there was still a shortage, and overalls had to be used as substitutes; mosquito nets were also scarce. Gunther, working in close liaison with Lieut-Colonel E. Ford, a leader in the army's anti-malaria campaign, succeeded for the first time in enforcing effective anti-malaria measures in air force units. These included the wearing of proper protective clothing, the taking of prophylactic drugs—quinine and later atebrin—and the use of repellent lotions. Meantime, a mobile Hygiene and Malaria Control Unit had been formed under No. 25 Base Wing consisting of a Hygiene Officer, Flying Officer A. S. Tredinnick, and seventeen unskilled hands. The unit carried out practical field training in the Bomana swamp area. The course included instruction in the draining of breeding grounds, the proper use of knapsack sprays and of malariol, and the identification of anopheline larvae and adults.

The only supply organisation at Moresby was a Repair and Salvage Unit, which was not suitable for handling medical supplies. Wing Commander Fulton arranged for the construction of a medical store to be staffed by No. 45 Operational Base Headquarters, and from that time medical supplies were readily available to units in New Guinea.

The Japanese, having failed to take Moresby from the sea, in July 1942 had landed a force at Gona, about 11 miles from Buna, and then began to push towards their goal over the Owen Stanley Ranges. The Australian squadrons at Moresby joined with the Fifth Air Force to support the Australian troops which barred their way.

The aircraft of No. 1 Operational Training Unit and of Nos. 6, 32 and 33 Squadrons carried supplies for the troops in forward areas. The "biscuit-bombers", as they were called, flew right up to the front line. Mostly unarmed, they were sometimes intercepted by Zeros, but they kept up supplies to the front. No. 1 Rescue and Communications Squadron evacuated men who were too badly wounded to stand the long carry back over the Kokoda Trail to Moresby.

No. 4 (Army Cooperation) Squadron, flying Boomerangs and Wirraways, which sent small flights to Popondetta and Dobodura after the Japanese had been pushed back to the north coast, carried out photographic reconnaissance and directed artillery fire against jungle-concealed targets. Medical care for the advanced flights was provided by a medical

orderly attached to each. In the rather primitive conditions under which the men lived, anti-mosquito precautions were sometimes neglected, and the result was a high incidence of malaria. The squadron medical officer, Flight Lieutenant B. C. Pirie, made periodical inspections of the advanced flights, and when he had enforced a stricter anti-malaria discipline the position improved. By 23rd January 1943, Gona, Buna and Sanananda were in Allied hands.

No sooner had the battle for Papua been won than the Japanese launched a surprise offensive with the object of seizing Wau airfield in the Bulolo Valley. They advanced to within a few miles of Wau before reinforcements could be brought from Moresby to throw them back. Nos. 22 and 30 Squadrons went into action, and No. 4 (Army Cooperation) Squadron sent a flight to operate from Wau. On 4th February the Japanese began to withdraw.

In the same month a detachment of No. 2 Air Ambulance Unit, with two De Havilland Dragons, arrived at Port Moresby, and was accommodated by the Rescue and Communications Squadron. It began a service, mainly between Milne Bay and Moresby, and also made flights to outlying emergency strips.

In March the Moresby-based R.A.A.F. squadrons shared in an overwhelming victory. This was the battle of the Bismarck Sea. On 1st March an Allied reconnaissance aircraft found a large Japanese convoy of 16 vessels passing along the north coast of New Britain, presumably on its way to reinforce Lae. Over a period of days Allied aircraft sank all the transports and some of the escorting destroyers.

No. 3 M.R.S. had been extremely busy from the time of its establishment, and by March 1943 was accommodating more than 100 men. In April a small advanced flight of the hospital was sent to Dobodura to cope with the medical needs of flights of Nos. 22 and 30 Squadrons, which had begun to operate there. Dermatitis was the main medical problem at Dobodura. It was caused chiefly by the itch mite, *trombicula,* and an R.A.A.F. entomologist, Flight Lieutenant D. C. Swan, carried out a brief mosquito and mite survey in the area, after which he was able to make recommendations regarding control. Another problem was the shortage of general stores. Those of particular concern to the medical branch were extract of pyrethrum, vitamin *C* tablets, wheat germ, salt tablets, anti-malaria clothing and wire gauze for mosquito and fly-proofing.

The parent unit at Moresby was finding it impossible, because of the increase in admissions, to give proper convalescent treatment, and a convalescent depot, No. 8, was formed at Sogeri. This unit began receiving patients on 15th August. The site was ideal, being at a high altitude, warm in the day and very cool at night.

A problem which was causing some concern at this time was the evacuation of casualties by air from forward areas. Most of the medical officers in Port Moresby were appalled by the conditions under which the wounded were evacuated. There were no arrangements for taking care of them at the strips, except those made by the Salvation Army, or for

providing them with medical attention on their journey. Later, as a result of the efforts of the medical branch, hot meals were packed in vacuum flasks, but this was the merest palliative, and it was obvious that the problem could only be solved by the provision of properly fitted aircraft.

As the battle moved northward the combatant units began to leave Port Moresby, which continued to be of interest to the R.A.A.F., however, because it now contained a large overhaul depot for aircraft, and acted as a staging point for sea and air transport. When No. 3 M.R.S. departed, No. 12 Medical Clearing Station provided hospital facilities for R.A.A.F. patients in the area, and from the later months of 1944 was the only hospital in Port Moresby. Patients from all the Australian and American Services were treated there.

NORTH-WESTERN AREA

After the raid in February the headquarters were moved back to Birdum, and most of the men and aircraft to Daly Waters, 60 miles farther south. Conditions at Birdum, which was an arid place, were uncomfortable, but at Daly Waters they were worse. There large numbers of men, for whom no preparation had been made, suddenly poured into camp. R.A.A.F. units did not at that time carry general hands on their establishments to attend to hygiene, and specialist personnel could not be spared for the work. Almost inevitably there were outbreaks of dysentery and diarrhoea, and malaria, dengue and infected sores added their quota to the daily sick parade. Most of the men with these last three conditions, however, had been medically unfit when they entered the area. To nurse patients the medical officers took over the local hotel, which was highly unsuitable for the purpose. It was built of galvanised iron and wood; the bathroom had no apparatus for the disposal of ablution water, and the closet pit was not fly-proofed. On 17th March a new camp was occupied in virgin country to the north of the old site. The S.M.O., Squadron Leader D. G. Howle, was by then in residence, but medical conditions continued to be difficult until May when a mobile surgical team arrived, which eventually became No. 1 Medical Receiving Station. The commanding officer was Wing Commander D. S. Thomson.

As reorganisation got under way after the raid the squadrons began to move north again, and with them No. 1 M.R.S. No. 12 Squadron set up at Batchelor, Nos. 2 and 13 Squadrons at Hughes, and No. 1 M.R.S. at Coomalie Creek, about 55 miles south of Darwin. At Batchelor the squadron medical officer, Flight Lieutenant E. J. Davies, with the help of three orderlies, provided medical attention for about 1,200 people —R.A.A.F., Australian Army, American Air Force, as well as employees of the Public Works Department, the Railway and the Roads Board. Hygiene was unsatisfactory because there was no labour to carry out the necessary work. At Hughes, too, labour for the purpose was wanting, but the position was not so serious because the water-supply line to Darwin could be tapped and the water reticulated to the camp.

Meanwhile, new squadrons and miscellaneous supporting units were coming into the area. By December Nos. 76 and 77 Squadrons, armed with Kittyhawks; No. 31 (Beaufighters) and No. 18 (Netherlands East Indies), armed with Mitchells, had arrived. Soon afterwards No. 319 Squadron of the U.S.A.A.F., equipped with Liberators was based at Fenton, and three Spitfire squadrons arrived from England. These were No. 54 Squadron R.A.F. and two Empire Air Training Scheme squadrons of the R.A.A.F.—Nos. 452 and 457.

The units which had moved back from Darwin had been forced to build their own camps, building materials being available to them for the purpose, and usually the standard of hygiene varied with the enthusiasm of the medical officer. Later an Area Works Office took control of camp construction, and mobile works squadrons carried out the actual building, installing hygiene fittings which had been manufactured without reference to the medical sections and which were often inefficient. These difficulties continued for some time, for even when the units were able to provide labour for hygiene work, they no longer had access to the necessary material.

Other hygiene difficulties were encountered on the overland route from Adelaide to Darwin. Many cases of bacillary dysentery had occurred among men travelling over the route and in November 1942 the Deputy P.M.O., Flight Lieutenant W. R. F. Fox, made the journey himself to check on conditions. He found a very unsanitary state of affairs at most of the staging camps and meal points along the way, where little or no attempt had been made at control of disease vectors. As a result of his efforts, a strict hygiene procedure was henceforth imposed on air force men in transit, and with the cooperation of the army, which controlled the staging camps and meal points, conditions rapidly improved.

At the end of 1942 the P.M.O., Wing Commander J. C. Laver, recommended that a mobile hygiene squad, such as was already operating in New Guinea, should be raised in North-Western Area, and early in 1943 this was done. The squad, which had an establishment of one sergeant and 15 other ranks, did excellent work in controlling not only the anopheles but the vector of other insect-borne diseases such as dengue and dysentery.

Towards the middle of 1942 a number of cases of malaria had occurred in the area, some of local origin and others importations from the north, and the possibility of the disease spreading again began to cause alarm. The G.O.C. Northern Territory Force directed that all army men suffering from malaria were to be treated in hospital in mosquito-proof beds and evacuated to non-tropical areas as soon as possible, while all ships' crews, both naval and mercantile, were to be examined for evidence of malaria immediately on entering port. The arrival in September of No. 76 Squadron from Milne Bay caused some dismay, as it seemed probable that a large proportion of the men would be infected. Blood tests were taken, and anyone who had a positive blood slide was put in the "bird-cage"—a mosquito-proof wire enclosure containing four beds. Airmen so

restrained were not resentful, for they knew that they would be put on the first aircraft leaving for the south.

The fear of a malaria outbreak persisted well into 1943. In April the army issued an Administrative Instruction that mosquito nets, trousers and long-sleeved shirts were to be universally used; that anyone who had had an attack of malaria within the last four months was to be evacuated from the territory as soon as possible, and that anyone who had suffered previously from malaria or who had lived in a malarious area during the past twelve months was to be blood tested for the presence of malaria parasites. It was not possible for the air force to follow the army in all details of this anti-malaria policy. Complete supplies of mosquito nets and anti-mosquito clothing did not become available to the R.A.A.F. until the end of the year. Nor was it ever practicable to evacuate all air force personnel who were infected with malaria, although the P.M.O., then Wing Commander R. B. Davis, considered that this should be done. The Air Staff had given an assurance that squadrons from malarious areas would not be brought into the territory, except in cases of emergency, but the conditions creating an emergency, he thought, might become very elastic. In the event, the precautions taken were adequate, for no large-scale outbreak of malaria ever occurred.

It was monotony rather than malaria which proved, in fact, the greatest waster of manpower in the area. The purpose of the squadrons stationed there was to attack enemy air bases and shipping to the north, and usually attack was followed by reprisal. There were, however, long periods when little was happening to some squadrons, and with no facilities for entertainment to fill the interval of waiting, numbers of the men, particularly those who had had mild attacks of endemic disease, were seized by feelings of frustration and depression. To this physical and mental state the term "tropical fatigue" was applied. The medical receiving station coped with the problem better than other units by seeing that the men were kept busy. During slack periods parties of them would be sent off on fishing or shooting trips, which as well as providing relaxation for the men, supplied their unit with fresh food. But even at the M.R.S. the monotony was so great that the air raids which broke it were welcomed. The hospital was linked up to the operations room by telephone and when there was a raid proceedings would be broadcast over the public address system. A great deal of research was done by the Services on the subject of "tropical fatigue", and this is described in some detail in a later chapter.

CHAPTER 26

MILNE BAY TO NOEMFOOR

MILNE Bay on the extreme south-east tip of New Guinea had offered the Japanese, with their eyes still covetously fixed on Port Moresby, a site for an advanced base from which to make another strike. To deny them the advantage the Allies began to garrison Milne Bay in June 1942 in the face of formidable obstacles of climate and terrain. The area of occupation was confined to a narrow band of coast, which was ringed on three sides by dense jungle, beyond which rose the jagged peaks of the Stirling Range. The atmosphere was steamy, and in the wet season it rained incessantly. The first strip, although still far from perfect, was ready to take aircraft within six weeks. Heavy rains had fallen, converting the area into a sea of mud, and over this a landing mat of steel mesh had to be laid. There were no dispersal bays, because if aircraft had been taxied off the mat they would have bogged. In August the main parties of Nos. 75 and 76 (Kittyhawk) Squadrons R.A.A.F. arrived, followed later by a flight of Hudsons from No. 6 Squadron. Two infantry brigades, the 7th and 18th, eventually formed the main part of the garrison.

Milne Bay was known to be heavily infected with malaria. Malign tertian was endemic, and the native spleen index extremely high. Occupation of the area had been planned under conditions of secrecy, which made it impossible to build up adequate supplies of medical equipment or to train the force to a high standard of malarial discipline. The mosquito repellent supplied was unsatisfactory, as was the type of mosquito netting, although in the event this was not of vital significance because the men were to have little time to spend under mosquito nets. The clothing available was shorts and short-sleeved shirts. The necessity for wearing sleeved shirts and long trousers was recognised, and an effort made to obtain supplies from American sources, but for a long time overalls and boots had to be worn instead. Quinine was the suppressive used; the dosage was 5 grains daily, and, when this did not prove effective, it was increased to 10 grains.

The medical officer of No. 76 Squadron was Flight Lieutenant N. L. Newman. He had been included in an advanced party which had flown to Milne Bay to set up a camp for the squadron, and had helped to choose a site on the beach where the breeze kept away the mosquitoes to some extent, but it was too far from the strip and was moved closer to it. No. 75 Squadron, when it arrived, camped in the vicinity. However, it was decided that the camps of both squadrons were too vulnerable to air attack and they were moved to the shelter of a coconut plantation; the proximity of dense vegetation brought swarms of mosquitoes, and malaria increased. Sanitation also caused concern. The principle was to build pit latrines, but with rain falling all the time the pit would fill with water within 24 hours, causing the contents to overflow. In No. 75

Squadron the medical officer, Flight Lieutenant W. Deane-Butcher, found an answer by having a mound built with a lavatory at the top.

In the endless rain, the mud and the heat, appetising meals would have provided a respite, but the meals at Milne Bay were monotonous: bully beef, beans and biscuits thrice daily. The cooks were not to blame for, with inadequate equipment and under the most uncomfortable conditions, they strove hard to feed the squadrons. They were provided with wood stoves, but there was never any dry wood, and at times when a supply ship could not put in there was not even enough food. Two cooks from No. 75 Squadron did manage to provide a small oasis of cheer. They set up a kitchen in the stand-by tent next to the strip, and as often as possible they would put on a delectable afternoon tea which included fresh cream and strawberries. These luxuries were provided by bomber crews coming up from Townsville, with whom the cooks maintained a close liaison. The bomber crews also brought up a little alcohol.

The general diet, however, was unsatisfactory and caused a carbohydrate dyspepsia in aircrews who complained of distension and colicky pains when proceeding even to medium altitudes. Had the fighting taken place over a longer period, it is probable that they would have had difficulty in carrying out their duties. This demonstrated to nutrition experts that a ration scale which was suitable for infantry, who were usually very hungry after hard physical labour, was quite unsuitable for aircrews, whose job was almost sedentary and whose digestion was often disturbed by aerial combat.

It had been arranged that an army casualty clearing station should provide hospital accommodation for the air force in the period immediately after its arrival. The 110th C.C.S. landed towards the end of August, but as much of its equipment had been ruined because of ineffective packing, it had been unable to set up more than 50 beds by 27th August. It was, besides, 10 miles from the air force camp over roads so narrow that it was difficult for vehicles going in opposite directions to pass and so muddy that the ambulances, which were not of the four-wheel-drive type, were always liable to bog down. The only other hospital accommodation was an American station hospital. The medical officer of No. 75 Squadron therefore nursed minor sick in their own tents, and sent only the seriously ill to hospital. No. 76 Squadron had a sick-quarters on top of a hill to the north of the strip in a long palm hut, which held about 20 beds. Flight Lieutenant Newman performed a major operation there on a pilot who had bullet wounds in his shoulder, and also managed to do some work on malaria diagnosis; blood films were made, and under his direction the medical orderlies became proficient in staining smears and searching them under the microscope for parasites.

The Japanese were aware of developments at Milne Bay, and on 4th August their aircraft appeared over the base. Two were shot down by No. 76 Squadron for the loss of one destroyed on the ground. On the 24th seven barges were observed to the north, and soon afterwards one of the Hudsons on a seaward reconnaissance sighted a large convoy

which seemed to be heading for Milne Bay. The Kittyhawks found and attacked the barges with success, and the next day set out with the Hudsons to attack the convoy. Despite dense cloud they located it, and damaged one ship. But the enemy came on, and in the early hours of the 26th made a landing on the north shore of Milne Bay.

At dawn the Kittyhawks and the Hudsons took off to attack the Japanese landing force. With rain still falling and the steel landing strip sinking into the mud, they somehow all managed to get into the air. Target visibility was poor because of the rain and density of the jungle but through the 26th and 27th they bombed and strafed, coming back to the strip to refuel and rearm and promptly taking off again. From one such sortie Squadron Leader Peter Turnbull, the commanding officer of No. 76 Squadron, did not return. Meanwhile, the ground staff laboured with dedication, belting ammunition, repairing and refuelling aircraft, and dragging them through the mud to the runway. No one any longer had a change of dry clothes and about one-third of the men had malaria. During the day they were bombed and strafed by Japanese planes, and at night they were shelled by Japanese warships, which appeared in the harbour for the first time on the 26th.

In the midst of this pandemonium Deane-Butcher became fearful for the safety of the medical panniers which contained all his equipment. He had pits dug and poles inserted on which the panniers could be suspended by the handles, but within a few hours the holes had filled with water, and the equipment was saturated.

The 7th Brigade, which met the first Japanese impact on the ground, was slowly pushed back after bitter resistance. By the 28th the Japanese had almost reached the airfield, and it was decided to send the aircraft and their crews back to Moresby for the night. The camp area was threatened and the ground staff was ordered to evacuate, but in the confusion it had not been decided where they should go. Deane-Butcher found a deserted plantation some miles away, and prepared to move the camp there. He had 30 malaria patients, and as none of the vehicles could get through the mud, they had to go on foot. In addition to looking after his patients, Deane-Butcher managed to provide food and water for everyone and to keep the camp going generally, a matter of some difficulty as there was no water-supply at the new site; stores had been left behind, and the canteen which contained food for all the services in the area had been blown up when it seemed that the Japanese would break through.

The next day the aircrews returned, and they did not leave Milne Bay again until the issue had been decided. This was not to take long. On 31st August the army and air force, working as one, succeeded in halting the Japanese and then began to push them back. By 7th September the battle for Milne Bay had been won.

In September No. 76 Squadron was moved to Darwin and No. 75 Squadron to Horn Island, a flat, uninteresting place with a hot, dry climate and a water-supply which depended on one well. There were about 300 men on the island, most of them doing strenuous work, and

each was rationed to one bottle of water a day. Even so, the supply dwindled alarmingly, and the time came when only one tank remained. The situation took an ugly turn when a guard on the tank was overpowered, but just then fresh water was found in other wells. Many of the members of No. 75 Squadron had malaria. Among them was the medical officer, who could barely drag himself out of his tent to look after his patients. The latter were nursed in their own tents for there was no R.A.A.F. hospital on the island, and the seriously ill were sent to a hospital on Thursday Island if the strong and irregular currents permitted; if they did not, R.A.A.F. patients were treated at a local American hospital.

After urgent representations No. 75 Squadron was withdrawn from Horn Island and sent to Cairns, where it proceeded to refit. While there the Kittyhawk pilots were instructed to carry out a mock attack on an American motor torpedo boat. One of them made a low turn and went into the sea. Squadron Leader W. S. Arthur, the new commanding officer, and Deane-Butcher were in the motor torpedo boat; they saw the pilot come up, apparently unconscious and surrounded by debris and burning petrol; they immediately dived in and succeeded in bringing him to the shore where he recovered. From Cairns the squadron returned to Milne Bay.[2]

At Milne Bay American fighter squadrons armed with Airacobras had relieved Nos. 75 and 76 Squadrons. Hudsons from No. 6 Squadron continued to carry out armed reconnaissance in the Bismarck Sea area, and they were joined in these operations by a flight of torpedo-carrying Beauforts from No. 100 Squadron, based on Townsville.

The danger of a Japanese landing had temporarily passed, but a more insidious enemy now threatened the force—malaria. To meet the threat the Director-General of Medical Services directed that Squadron Leader John Gunther should go to Milne Bay as Senior Medical Officer for the air force there. Before the war Gunther had worked in the Milne Bay area as a medical officer for Lever Brothers' plantations. He set up a sick-quarters at No. 43 Operational Base Unit, and by the end of 1942 had 30 beds under canvas, together with a medical store, kitchen, patients' mess, staff mess and a well-equipped laboratory. The army malaria control units had not yet served the area and Gunther instructed all air force units to carry out spraying in their own lines and for as wide a radius as possible round the camp site.

As mentioned earlier, air force units in New Guinea had been transferred from the command of North-Eastern Area Headquarters to the newly created No. 9 (Operational) Group, with its headquarters at Port Moresby. The commanding officer was Group Captain W. H. Garing. Garing was well aware that disease was threatening the efficiency of operational units, and he gave the utmost possible cooperation to his Principal Medical Officer, Wing Commander J. C. Fulton, in seeing that prevention measures were carried out. He instructed his commanding officers

[2] On this occasion Deane-Butcher thoughtfully provided himself with an umbrella.



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to make full use of the services of their medical officer and in particular, to:

(1) obtain the advice of the medical officer before selecting a new site for occupation, or make arrangements with the Principal Medical Officer for a hygiene officer to be available;
(2) make regular inspections of the camp area and quarters in company with the medical officer;
(3) see that unit detachments and advanced flights were visited as often as possible by the medical officer;
(4) see that frequent instruction was given to all personnel in tropical hygiene and sanitation by the medical officer.

Garing impressed upon his commanding officers that disease prevention was their responsibility, and he added that the incidence of preventible disease was an indication of the standard of discipline within a unit.

In February 1943 part of the R.A.A.F. Mobile Hygiene and Malaria Control Unit arrived in Milne Bay under Flying Officer A. S. Tredinnick. Tredinnick had little equipment, and only six general-hands, and he found that native labour was scarce. Fortunately, it was possible to arrange with Colonel S. H. Lovell, the A.D.M.S. of the 5th Australian Division, for a combined army and air force drive against malaria. It was decided that the R.A.A.F. unit would function separately to the army malaria control units, but that Major I. M. Mackerras, who had a team of entomologists, would be available to help the R.A.A.F. units with advice on identifying the various anopheline species and also on their breeding habits. In the area at the time were No. 71 Wing Headquarters, Nos. 6, 75, 77 and 100 Squadrons, No. 9 Mobile Fighter Sector, No. 37 R.D.F. Station, No. 10 Repair and Salvage Unit, No. 6 Mobile Works Squadron, No. 10 Works Supply Unit, No. 43 Operational Base Unit, No. 26 Stores Unit and No. 2 Medical Receiving Station. A list of drainage operations covering the areas round the camps of most of these units was submitted through Colonel Lovell to Angau, and accepted. Tredinnick was allowed to draw 300 natives each day for the work, the army providing transport for the natives. Each general hand was allotted a team of 50 natives, and each team was given a specific task, such as spraying, permanent drainage work, clearing vegetation, or filling wheel ruts.

Early in 1943 atebrin was substituted for quinine as the approved suppressive drug. At the same time a general order was issued that members of all Services in malarious areas should wear full protective clothing, a futile injunction as far as the air force was concerned for anti-malaria clothing was still in short supply, many men having only one pair of slacks and one long-sleeved shirt.

However, as a result of the measures taken, the malaria rate began to fall rapidly. Before January 1943 when a start was made in keeping statistics, it was estimated that the number of cases per 1,000 was approximately 100 per week. After January this figure decreased until by early 1944 it had fallen to about one per 100 per week—a triumph for the malaria control units.

No. 2 M.R.S. had arrived in the area in December 1942 but it took a long time to become established; even in January some of its patients had to be sent to the mainland for a proper investigation of their condition. The P.M.O., not unnaturally, was dissatisfied, and, after an investigation by Group Captain Daley, the staff of the M.R.S. was reorganised. Wing Commander C. J. N. Leleu, formerly of No. 3 M.R.S. Port Moresby, became the commanding officer and Flight Lieutenant H. E. Williams, the physician. Squadron Leader C. P. Hudson, who had been the unit's surgeon during its service in New Guinea, continued in this capacity.

One reason for the unit's failure to become operative within a reasonable period was its unsatisfactory location. This was beside a river, which during the wet season always flooded. Leleu's first move was to select a new site on more suitable ground and closer to the R.A.A.F. area. The wards and ancillary buildings were completed in January 1943, and the unit began to receive patients immediately. By September 1943 it was able to accommodate members of the nursing staff and to undertake all its commitments, only those patients being evacuated to the mainland who, it was believed, would still be unfit for service after three months in hospital.

After Allied successes in the Buna-Gona area and the establishment of a large United States Army Air Force base at Dobodura, there was a general exodus of operational units from Milne Bay, and by June 1943 the area was deemed secure enough to be developed as a supply base. No. 9 (Operational) Group moved its headquarters there in June; other units already in the area were No. 17 Stores Unit, which was the base supply unit for the R.A.A.F., ancillary units required to maintain the strip, and No. 33 (Transport) Squadron. The Medical Section ("R" Group) of No. 17 Stores Unit was set up in July. Squadron Leader R. A. Spinney was the commanding officer, Flight Lieutenant C. W. Fitton the pharmaceutical officer-in-charge, and there were also two N.C.O's, one airman and one native boy on the staff. The store replaced a similar one in Port Moresby, and provided an advanced point for the distribution of medical stores. Medicines were manufactured in bulk in the dispensary, packed in empty cordial bottles from the canteen, and distributed to forward units. Roof catchment water was used for dispensing purposes as chlorinated river water presented problems of chemical incompatibility. Regular checks were also made of the lead content of the water as the material available for roofing was not entirely lead-free, and there was difficulty in obtaining lead-free paint. Early in 1944 floods damaged some 20 to 25 per cent of the stores. These were replaced by intensive salvage work and by rapid re-supply from Australia, and no critical shortages arose, although unit medical officers accepted very reluctantly such items as water-stained surgical gloves, despite the fact that their usefulness remained unimpaired.

As the advance proceeded along the coast medical officers were posted away from units in the area, and until the beginning of 1944 No. 2 M.R.S., assisted by the medical officer of No. 33 Squadron who remained,

carried out medical treatment, including sick parades, for all air force personnel, as well as providing hospitalisation for the air force and for other Services. The army did not establish a general hospital at Milne Bay, and when the 2/1st and the 110th Casualty Clearing Stations moved out the more seriously ill army patients were sent to No. 2 M.R.S., the less seriously ill being attended to by a field ambulance. All hospitalisation for the Australian naval base at Milne Bay and, when necessary, for the Australian squadron was carried out by the medical receiving station. Gradually the number of naval hospital patients increased. The Director of Naval Medical Services agreed to supply naval staff to take care of them, and in April 1944 naval staff for two wards arrived. Subsequently naval staff and equipment were built up until in August 1944 the R.A.N. was able to take over the hospital, and No. 2 M.R.S. moved to Madang, which had recently been occupied.

Goodenough Island was recaptured from the Japanese by the 2/12th Battalion in October 1942. It was planned to establish an R.A.A.F. base on the island with a fighter wing to cover Goodenough and Milne Bay and a bomber wing to operate against Rabaul. A radar unit moved in first to provide information about enemy air movements, and then came two mobile works squadrons, Nos. 5 and 7, to build strips and camps. No. 5 Squadron flew in in January, followed a few months later by No. 7 Squadron.

Medical care for the radar unit had been provided by a sergeant nursing orderly but each of the works squadrons had its medical officer. Flight Lieutenant R. E. Ashbarry, the medical officer of No. 5 Mobile Works Squadron, accompanied the advanced party. He brought with him a mobile dispensary specially designed to meet the needs of the unit. It consisted of a large three-ton truck with medical equipment built in, and was ready for holding sick parades and giving minor medical treatment as soon as the doors were opened and a canvas fly thrown over the rear end. The medical officer of No. 7 Mobile Works Squadron was Flight Lieutenant V. W. J. O'Reilly.

In each squadron tented sick-quarters of 20 beds were set up. Patients who were slightly ill were treated there, but the seriously ill were evacuated to No. 2 M.R.S. at Milne Bay by aircraft of No. 2 Air Ambulance Unit. In May No. 2 M.R.S. sent an advanced medical flight to Goodenough under Flight Lieutenant F. V. Munro so that hospitalisation could be provided locally. The advanced flight began with 30 beds under canvas, which in succeeding months increased to 80.

In May and June three fighter squadrons, Nos. 76, 77 and 79, arrived followed by No. 73 Wing Headquarters, No. 26 Repair and Salvage Unit and the three bomber squadrons, Nos. 8, 22 and 30. By the end of June the R.A.A.F. had 3,600 men on the island.

A field hospital was obviously required, and it was decided to transfer No. 5 M.R.S. from Townsville. An advanced party of fifteen men under the unit's pathologist, Squadron Leader B. J. Basil-Jones, was sent up

to select a site. Basil-Jones was attracted by a plateau on the eastern side of the island. Its only drawback seemed to be that it was separated from the aerodrome by three or four streams, which would have been inconvenient in the wet season, and so he rejected it—fortunately, as it happened, for there was an outbreak of scrub typhus in an American hospital later erected on the site. A satisfactory location was chosen for No. 5 M.R.S. By the time the main party arrived in August some levelling and road work had been done and two large native huts erected. Within nine days patients from outlying units were being admitted, and within a month the unit was fully operational, providing accommodation for about 100 patients. X-ray equipment was installed, also a mobile pathology laboratory, which Basil-Jones and Wing Commander R. R. Macdonald had designed in Townsville; all the equipment fitted easily into cases, and was fully mobile. Consultations were available at the M.R.S. four days a week. In the same building was a dental centre under Squadron Leader J. C. Homewood.

In the first month the main work of No. 5 M.R.S. centred on a dysentery outbreak, mainly in No. 8 Squadron and No. 7 Mobile Works Squadron. As the epidemic cleared up the number of skin cases increased, and during the whole of its stay on Goodenough the M.R.S. always had numbers of patients suffering from tinea and the various eczemas. Malaria was also troublesome. There was a high incidence in No. 7 Mobile Works Squadron, due in part to its camp site which was in a gully on both sides of a slow-running stream, and in part perhaps to lack of anti-malaria discipline in respect of clothing. No. 5 Squadron which was camped on a hill did not suffer so severely.

Food was supplied by the Americans. It came in great variety, but after a time palled on Australian tastes, which preferred something more solid. Special provision was made for the sick. Flight Lieutenant W. D. Cunningham of No. 5 M.R.S. had been worried by the lack of proper food for invalids at Port Moresby and when he came to Goodenough he brought a miniature farm with him. Goats provided fresh milk, and fowls and turkeys a constant supply of eggs and poultry. This happy state of affairs was threatened when the chickens began to disappear, but the villain, a large python, was quickly found and dispatched. Cunningham also brought a plough, and the unit grew its own corn. A large vegetable garden, which had been started by the army, supplied medical units with fresh lettuces, tomatoes and other fruits, and more fruit was brought in by No. 2 Air Ambulance Unit from two small missions on the mainland.

The bomber squadrons based on the island made constant and heavy attacks on Rabaul as well as Japanese bases in the Solomons. There was surprisingly little retaliation, and in November it was considered safe to bring up nursing sisters for the M.R.S.

The strength of the R.A.A.F. on Goodenough from July to October 1943 reached a total of about 6,000; later the number gradually declined. Whereupon the Americans and their equipment began to pour in. Goodenough became the main training base and storage camp for the Sixth

American Army, and the 1st Marine Division was brought in for training for the landing at Cape Gloucester.

Kiriwina. On 30th June units of the Sixth American Army landed unopposed on Woodlark and Kiriwina Islands in the Trobriand Group, where it was proposed to establish strips from which to provide air cover for the seizure of the Huon Gulf area.

In August No. 6 Mobile Works Squadron, whose medical officer was Squadron Leader F. G. Favaloro, moved to Kiriwina and began preparing a strip for the squadrons of No. 73 Wing which were to form the air garrison. In the same month a malaria control unit consisting of one sergeant and six others arrived. The area to be controlled included the sites of all R.A.A.F. units with the exception of the works squadron, which was preparing a strip at the northern end of the island. The villages within the area of R.A.A.F. control were inspected every six days and the usual measures of oiling, draining and treating wells with petrol were carried out.

No. 3 M.R.S. under its commanding officer, Wing Commander G. J. B. Baldwin, landed soon after the squadrons and by September was fully operational with a capacity of 80 beds. Its site was an excellent one, approached by an all-weather road. During September there was a small sporadic outbreak of dysentery, averaging 2.5 cases per 1,000 per week, but it quickly subsided. The malaria incidence during the month was negligible, averaging 0.8 per 1,000 per week.

In November four additional squadrons—Nos. 22, 24, 30 and 78—moved into Kiriwina. Camp sites were chosen for them by the S.M.O. of the wing, Squadron Leader E. W. Field, and the hygiene officer, and when they arrived they found that American works units had put up essential buildings. Their coming meant an appreciable increase in the volume of work at the M.R.S., where as many as 100 patients were accommodated. The M.R.S. also treated natives, and one of its medical officers visited the native hospital weekly. The arrival of nursing sisters in February 1944 was very timely.

During the first two months of 1944 operations from Kiriwina decreased, and the squadrons were instructed to pack up for a move to the Admiralty Islands. No. 3 M.R.S. was also instructed to pack up, and most of its patients were transferred to the Operational Base Unit. Arrangements were made for seriously ill R.A.A.F. personnel to be admitted in future to an American hospital on the island, and for other patients to be evacuated to No. 2 M.R.S. direct. The destination of No. 3 M.R.S. turned out to be Townsville, but a part of its equipment and personnel was used to form No. 26 M.C.S., which accompanied No. 73 Wing to the Admiralties.

Lae and Nadzab. Meanwhile on the mainland of New Guinea the Allies had been making plans during 1943 for the capture of Lae and the Markham Valley. In an effort to distract attention from their objectives they began to exert heavy pressure in the Mubo-Salamaua area, the R.A.A.F. squadrons at Moresby assisting. In July Nos. 22 and 30 Squad-

rons were transferred from Moresby to Goodenough and from there, with No. 100 Squadron based at Milne Bay, they attempted to blockade Lae by attacking barge traffic between New Britain and the mainland, while No. 4 (Army Cooperation) Squadron remained at Moresby to support the operations against Salamaua. Allied tactics were successful. On 16th September Lae was captured by forces of the 7th and 9th Australian Divisions, the latter landing on beaches to the east of the town and subsequently joining up with troops of the 7th Division who had been flown into Nadzab for the advance on Lae along the Markham Valley.

During the Lae-Salamaua operations an Air-Sea Rescue Unit, which was included in No. 45 O.B.U. at Port Moresby, performed outstanding work in rescuing airmen of both the Australian and American air forces whose aircraft had crashed. Much of the success of the unit was due to the enthusiasm of the medical officer of No. 45 O.B.U., Flight Lieutenant J. G. Shelton. When Shelton arrived in New Guinea in June 1943 the unit was in an embryonic stage; the crash-boats used in rescue operations were not reserved exclusively for the purpose; they were frequently unserviceable, their radios were inadequate, and they had no set crew. Shelton managed to secure a fast boat, which was equipped with an efficient radio, rubber dinghies, medical crash-kits, stretchers and emergency rations, and a special crew was allotted. In the event of a crash the routine was for the Rescue Operations Officer, Fifth Air Force, to alert the unit, whose members, led by Shelton, set out in the boat for the scene of the crash. If the crashed aircraft was beyond the range of the boat, a Catalina was used.

In July the crash-boat was sent out to attempt to rescue the crew of an American Mitchell which had dived into the sea near Bavo Island. They found that the plane had sunk and all the crew were dead. Shelton, who was a good swimmer, dived among the wreckage and succeeded in releasing three bodies.

Next month the crash-boat raced to the rescue of an American Lightning which had come down in the sea on the south coast of New Guinea. When it arrived the party found that the pilot, who had baled out and then become tangled with his parachute, had nearly drowned. Though unconscious when picked up, he survived. In September an American Liberator made a crash landing in shallow water near the beach in Bootless Bay. The front bombardier had been killed, but the rest of the crew were rescued and returned to base. In the same month Shelton was instructed to board an R.A.A.F. Catalina which was to make a landing in enemy-occupied territory. The Catalina was one of a special flight which during 1943 made regular sorties into the Sepik River area to land scouts and supplies. When the flying-boat came down supplies were quickly unloaded at the scouts' camp and Shelton attended to a few of the men who had been injured, one of them so seriously that he arranged his return to Port Moresby in the aircraft. In all, this mission took 10 hours, but of this time only 20 minutes were spent on the river because of the danger of detection by enemy fighters.

Again in September Shelton and his party located an American Mitchell which had crashed and sunk, and Shelton in an attempt to rescue members of the crew, dived repeatedly in waters known to be dangerous. On 2nd December he and his party rescued the four members of an American transport aircraft which had been forced down in difficult marshy country on the New Guinea seaboard.

When necessary a smaller and faster crash-boat was used in conjunction with the mother craft. On 17th December the Rescue Operations Officer reported that an American light aircraft had crashed in the jungle west of the Laloki River, and Shelton and his party set out to rescue the crew. They sailed down the west coast until they came to the mouth of the Laloki, where they had a rendezvous with a spotting plane. The plane dropped a message instructing them to go up the river, which they proceeded to do in the smaller craft and against a strong current, the plane indicating when they should stop and when go ahead. After 10 miles a log jam blocked the way. The spotter plane instructed them to return to the mouth of the river. There they had to drop anchor, as the light was fading.

At dawn next day another spotter plane appeared and guided them up the Brown River, which joined the Laloki at a spot above the log jam. Now the hairpin bends of the river often made the rudder useless, and the motor had to be used skilfully to stave off disaster. Crocodiles and snags abounded, and numerous large tributaries presented opportunities for going astray if the spotter plane had not kept them on the right course. The river banks were swampy and lined with high pit-pit grass, bread fruit trees, sago and banana palms and climbing and hanging vines. At the 25-mile point the plane dropped a note directing them to the scene of the crash. They leapt ashore, sinking to their waists in mud, and with the tall pit-pit grass above and around limiting their visibility to three feet. Two spotter planes buzzed them in the direction of the crash. After half an hour of cutting and plunging they came to a small lagoon, which they crossed with the water up to their waists. Insect pests were worse than usual, crawling inside and outside their clothes. In the long grass the spotting planes had lost them and they found that another and larger lagoon lay between them and the crash. At this point all the members of the party except Shelton dropped out. He swam to the centre of the lagoon, which was inky black and probably infested with crocodiles, and by splashing wildly succeeded in attracting the attention of the pilot of one of the planes, which circled back and dropped a message. Shelton opened this in the middle of the lagoon. It contained a plan showing the location of the crash and he set out alone on the last stage of the search. The heat was almost unbearable and the fine, grey swamp dust from the pit-pit grass, when dislodged, caught in his throat and made him choke. After two hours he came to the plane to find that the crew had been killed instantaneously. Their bodies were wedged in the wreckage, and it was impossible for him to move them without assistance. When he rejoined the rest of the party they returned to the boat.

After they had gone 10 miles a spotter plane appeared and dropped a message asking them to rescue an American search party which had also set out in an attempt to reach the crash. Although almost at the end of their endurance, they succeeded in locating this party. By now, however, the crash launch was nearly out of petrol. They signalled their need to the spotter plane and in half an hour two planes appeared, which dropped six 5-gallon drums, with Mae Wests attached to prevent sinking. One smashed on the river, two fell in thick vegetation, and three were recovered. When darkness came they found it very difficult to keep to the main stream, but they crept along and, by the light of an Aldis lamp, managed to avoid snags, shoals and crocodiles, whose red eyes glowed at them out of the darkness. After four hours and a half they realised they were lost. They tasted the water and found it brackish, which meant that they were near the mouth of the river and the mother craft, and so they fired a Very parachute. Immediately they received a reply in the form of a small searchlight. As the light appeared on the right they turned towards it, only to find that the farther they went the more lost they became. They weighed anchor with an almost empty tank at 11.30 p.m. Two more parachute flares were fired without result, and eleven men settled down for the night in an open 24-foot boat. At dawn they took direction from the sun and retraced their course. Happily, after just under an hour they struck the mouth of the river and the mother craft, which returned them safely to their base.

The knowledge that the Air-Sea Rescue Unit existed gave confidence to men of both air forces who were returning from operations in damaged aircraft. In all, it picked up thirty-five men during the New Guinea operations in 1943.

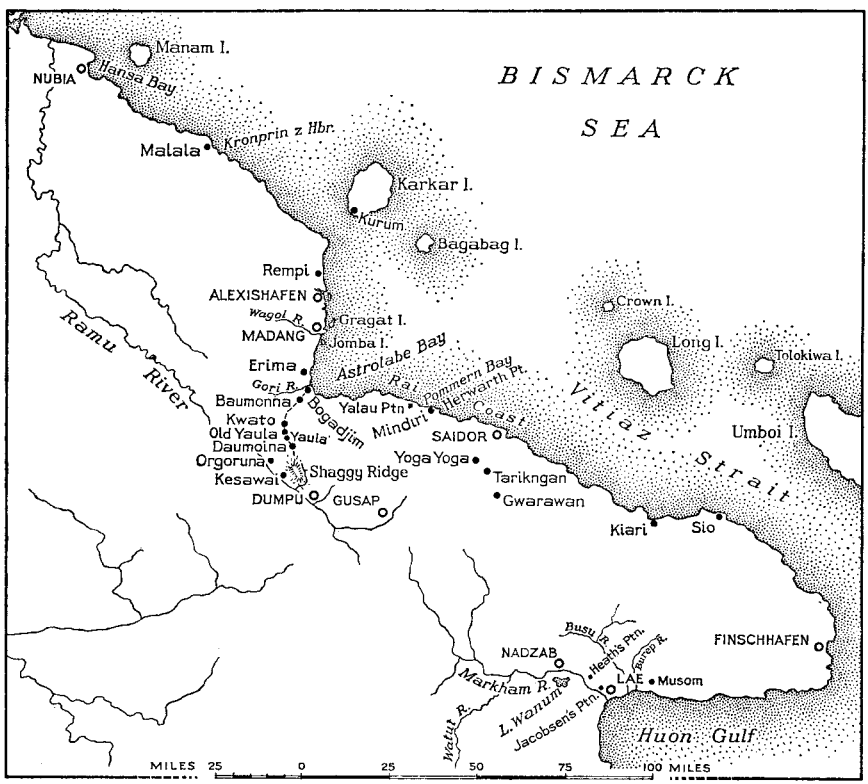
A new R.A.A.F. formation, No. 10 (Operational) Group, was posted to Nadzab in January 1944 in support of the Fifth Air Force. This group was intended to be highly mobile to allow the R.A.A.F. to keep pace with the Americans who were now advancing rapidly. It included a bomber and a fighter wing, each wing having three squadrons, a repair and salvage unit and a medical clearing station, while a malarial control unit was attached to the group headquarters. No. 23 M.C.S. was assigned to No. 77 (Dive-bomber) Wing and No. 24 M.C.S. to No. 78 (Fighter) Wing. A hospital, No. 5 M.R.S., which had become superfluous at Goodenough, was included in the group, but because of shipping difficulties it did not join its formation until September 1944 at Biak. The group was commanded by Group Captain F. R. W. Scherger, and the Principal Medical Officer was Wing Commander R. R. Macdonald.

Nos. 2, 6 and 7 Mobile Works Squadrons landed at Lae a few days after its capture and, working with the Americans, drove a road through heavily timbered country to Nadzab. They started work there on virgin ground and within the record time of sixteen days had built a double strip, which was later to be called Newton Field in honour of Flight Lieutenant W. E. Newton, V.C. The men worked day and night to get the job done,

but, in the process, neglected to take proper hygiene precautions. The price was an outbreak of dysentery.

R.A.A.F. and American units now streamed into Nadzab; in addition to the R.A.A.F. strip, three other strips were built, including a long bomber strip of 9,000 feet.

No. 23 M.C.S., commanded by Squadron Leader Adrian McGlynn, arrived at Lae on 28th January, and was the first medical clearing station



to function in the forward areas in New Guinea. Its equipment could not be unloaded for three days, and in the meantime two bush-timbered buildings belonging to No. 7 Mobile Works Squadron were taken over and transformed into a surgical and medical ward and the works squadron provided temporary messing facilities for the medical staff and patients. Within a week the unit was able to function independently. A few days later No. 24 M.C.S. under Squadron Leader C. A. Frew also became fully operational, and thereafter the medical work at Nadzab was comfortably shared by the two units. Before their arrival there was no R.A.A.F. hospital, although there were some 2,000 air force men in the area. The sick, apart from those who received treatment at the station sick-quarters,

had been looked after by the 111th C.C.S. through the courtesy of the commanding officer, Lieut-Colonel W. E. E. Langford.

When the medical units first arrived there were several air raids, but they did not threaten the hospital area. Indeed it was in far greater danger from Allied planes, being in the line of three air strips; several heavily laden bombers crashed on take off in the vicinity, the closest only some 600 yards away.

The medical work was interesting. There was some scrub typhus and a good deal of malaria, mostly contracted in isolated areas before the malarial control unit had gone into action, and dengue fever and enteritis were common. Skin diseases were also a problem and many eczematous conditions failed to respond to treatment in the tropical humidity, and had to be evacuated to the mainland.

In January No. 10 Group received its first assignment: Kittyhawks of No. 78 Squadron were to patrol the upper Ramu Valley, the Bogadjim Road and the north coast of New Guinea from Madang to Saidor. From 17th to 23rd January units of the group with the Fifth Air Force provided air support for the 18th Brigade in its attack on Shaggy Ridge. For the rest of the month squadrons of No. 78 Wing escorted R.A.A.F. and American bombers on their missions and carried out routine patrols of the Markham Valley between Gusap and Lae. The group's first casualties occurred on 27th January when two planes of No. 75 Squadron collided in mid-air killing both pilots. Early in March No. 78 Squadron also suffered loss when one of its planes was hit by anti-aircraft fire near Kronprinz Harbour.

In February 1944 General George C. Kenney, in preparation for a coming attack on the Admiralties, ordered the Fifth Air Force to put out of action the four Japanese air bases in the Wewak area. The operation began on 3rd February, Kittyhawks of Nos. 75 and 78 Squadrons providing escorts for the American bombers. On 24th February the Vengeances of Nos. 21 and 23 Squadrons dive-bombed targets at Hansa Bay, two aircraft being lost in the engagement. Vengeances also bombed the Japanese airfields at Alexishafen and Madang, making them useless for staging in any attacks which the enemy might make against the landing force in the Admiralties. Aircraft of Nos. 23 and 24 Squadrons bombarded Mindiri, west of Saidor, before the successful American landing on 5th March, and a few days later Vengeances attacked a village north of Alexishafen. This was their last mission. On 8th March the three Vengeance squadrons were ordered to return to Australia, as it was considered that the aircraft were unsuitable for active service.

No. 78 Wing was also ordered to pack, and with it its M.C.S., No. 24, which evacuated some 50 of its patients at 24 hours' notice. Their destination was Cape Gloucester. From then on No. 23 M.C.S. provided hospitalisation for all R.A.A.F. personnel at Nadzab, and when the army casualty clearing station moved out of the area, for army sick as well. The bed strength was consistently higher than the official maximum of 100.

When No. 26 M.C.S. began to function at Momote in the Admiralties and No. 22 M.C.S. at Aitape, No. 23 M.C.S. was on their line of medical evacuation, and often as many as 20 patients, ambulatory and stretcher, would arrive unexpectedly at the unit by air for onward transfer to the mainland. At first these evacuations were carried out smoothly, but difficulties occurred when the American line of medical evacuation was transferred to Oro Bay and Milne Bay. The fact that the evacuation planes were troop carriers without nursing sister escorts imposed a greater strain on the M.C.S., which had to send a medical orderly with the patients. The need for an aerial ambulance service was sorely felt.

Although medical work at Nadzab continued to be constant and interesting, the men of No. 23 M.C.S. felt that they had taken root in a back area of the war, and everyone was anxious to move farther on. Their wish was fulfilled when the unit was assigned as the M.C.S. to land on Noemfoor Island on the second day of the invasion.

New Britain-Cape Gloucester: In December 1943 landings were made in New Britain at Arawe and at Cape Gloucester by units of the Sixth American Army. Early in March No. 76 Wing moved into Cape Gloucester to provide direct air support for Allied operations in the area.

The M.C.S. of the wing, No. 24, was receiving patients within a few days of its arrival. Just before it moved from Nadzab the commanding officer, Squadron Leader C. A. Frew, was evacuated because of illness; Flight Lieutenant N. F. Pescott was placed in temporary charge until Squadron Leader E. D. M. Ryan arrived to take command on 28th March 1944.

The unit was fortunate in having a good site on a ridge, about three-quarters of a mile from and overlooking the airstrips. The medical work was not heavy, but was sufficient at least for the first six weeks to keep everybody occupied. A close association was established with American medical units in the area, and they were very helpful in the matter of medical supplies. There was also an interchange of ideas on tropical medicine and treatment, which was beneficial to both parties.

The Admiralties: In pursuance of the plan to isolate Rabaul, landings were made in the Admiralties in the early part of 1944. On 29th February the American 1st Cavalry Division went ashore at Los Negros Island, and quickly seized Momote airfield. Air support was given by Kittyhawks of No. 73 Wing, which began to come in as soon as the airfield was ready on 9th March.

Conditions at first were very difficult. Tents could not be erected because of the proximity of the Japanese line, and the men spent their nights in dugouts, often with the rain pouring down on them. The unburied bodies of dead Japanese attracted swarms of flies, which found their way to the food, and there was a good deal of enteritis. Malaria, dengue and dysentery also caused concern.

R.A.A.F. sick were admitted to an American hospital until an Australian medical unit landed on 16th March. This was No. 26 M.C.S., which had been formed at Kiriwina from men and equipment of No. 3

M.R.S. It was commanded by Squadron Leader K. S. Harrison. The unit went at first to a temporary camp and for about 10 days was without its equipment which was still on board ship. During this period the American Evacuation Hospital, though itself short of equipment, was of the greatest possible assistance. The camp site eventually allocated to the M.C.S. was on a peninsula covered with coconut trees and other vegetation. These were quickly cleared by American engineers, who also erected prefabricated wards and a theatre; floors in the wards and tents were made from coral. The unit became operational on 29th March, and on that day six patients were admitted.

On 3rd April Harrison received an urgent request for medical aid from Bat Island, a tiny island south of the Admiralties, where members of an R.A.A.F. radar unit had landed on 11th March. Harrison flew there in a Walrus aircraft. He found that five men were ill, one seriously. The latter almost certainly had scrub typhus. All the men had taken reasonable precautions; they had slept on stretchers or hammocks from the time they landed, and the majority had worn gaiters and applied anti-mite lotion to their socks and boots. A brief search did not reveal any mites, but the island had a suspicious history: one man in the Australian radar unit had already been evacuated by the Americans with a diagnosis of pneumonia; six Americans had been evacuated because of a feverish illness, almost certainly typhus; and two members of Angau had developed typhus there. Obviously the place had been polluted by thousands of sea-gulls, rats and wild pigs which had made it their home. Harrison brought the seriously ill man back to Los Negros with him in the aircraft, and instructed the other four to follow the next day by launch. In the middle of April the rest of the radar unit was withdrawn.

In all seventeen men from Bat Island were admitted to No. 26 M.C.S. with scrub typhus; two died; many of the others were seriously ill for a week to ten days, their nursing placing considerable strain on the facilities of the M.C.S. and the skill of the medical orderlies. Although there was some doubt about the first man, the others who contracted scrub typhus fell ill within 14 to 25 days of landing. The duration of pyrexia was from 14 to 23 days. An eschar was discovered in nine cases; the Weil-Felix reaction was positive in nine, negative in six and not estimated in two. A careful field study was later made on Bat Island by the Americans, and the result was reported in a comprehensive study of the U.S. Typhus Research Commission.

Conditions on Los Negros itself were unhealthy. After persistent rains the roads became cut up and the camp area a quagmire. The M.C.S. admitted numbers of men suffering from scrub typhus, dengue and dysentery. There were also a number of accidents, the most appalling of which occurred when an American Liberator and its bomb-load exploded in a camp, killing about 200 men and injuring another 300. There was only one Australian in the camp at the time, and he was admitted to the M.C.S. with injuries. At the beginning of April all 54 beds in the M.C.S. were occupied, and it became necessary to ask patients to bring

in their own beds and mosquito nets. Evacuation was by American ambulance aircraft to Port Moresby.

Fighting on the ground continued for five weeks during which the Japanese were pushed farther and farther back into the mountains towards the centre of the island. Aircraft of No. 73 Wing patrolled Los Negros airfield and supported American land forces at Hauwei Island, Lorengau airfield and other places on Manus Island, and later on Pityilu Island. Their main function, however, was to provide air cover for Allied shipping in the area.

Aitape: The Americans planned a landing at Hollandia for April 1944. They were advancing far ahead of established airfields in the Ramu Valley and would have to depend on carrier-based aircraft for initial air cover. The carriers could not, however, safely remain in the area while the infantry pushed inland some fifteen miles from the coast to reach their objective. To secure an airfield from which the Hollandia operation could be covered after the carriers had withdrawn it was decided to make a simultaneous landing at Aitape.

The R.A.A.F. was assigned a role in the Aitape landing. The units concerned, the Advanced Headquarters of No. 10 Group, No. 78 Wing and No. 62 Works Wing, proceeded in L.S.T's to Finschhafen, where they became part of a huge convoy. To deceive the enemy the convoy headed well north of the Equator past the Admiralty Islands, and then turned back towards Dutch New Guinea where it split up, three-quarters, which included the R.A.A.F. component, moving on to Aitape.

The works wing went ashore on 22nd April just behind the assault forces, and immediately began work on the airstrip. Within 43 hours of the landing the first Kittyhawks were able to touch down. Almost immediately some took off again to cover operations at Hollandia, where the plan to make a landing synchronous with the one at Aitape had been carried out. In the succeeding days the Kittyhawks continued to patrol over Hollandia and over Tadji airfield at Aitape. At Hollandia an enemy bomb had destroyed a large food dump, and the Kittyhawks also provided fighter protection for a stream of American transport aircraft which were ferrying food to Hollandia from Nadzab.

In general, the R.A.A.F. camps at Aitape were much more quickly established than they had been at Nadzab and Cape Gloucester; most of the officers and men were now experienced, and an amount of useless equipment had been discarded or lost. Unfortunately the camp sites of the airfield-construction squadrons (formerly called mobile works squadrons) were poor and so too was their hygiene. Later a hygiene officer, Squadron Leader G. W. Davies, was included on the staff of the P.M.O. In subsequent moves he checked camp sites, and there was no further trouble in this respect.

An irritating discovery was that Tadji airfield was unusable after a few inches of rain, being made of mud on clay soil, not coral as had been thought. Steel matting had to be laid over the whole strip and all hands from the R.A.A.F. worked continuously for 48 hours to get the job done.

Two weeks afterwards there was an alarming outbreak of malaria. The airstrip was between two swamps, and no doubt it was while laying the matting at night that most of the victims became infected. No. 2 Malaria Control Unit, under Flying Officer G. F. Gee, which was included in No. 10 Group Headquarters, went into action, and within a very short time succeeded in bringing figures down to normal. It is interesting to note that when the 6th Australian Division went into the area some months later and started offensive patrolling it had a high malaria rate, despite strict precautionary measures.

No. 22 M.C.S. was in No. 62 Works Wing. Its commanding officer, Squadron Leader S. W. Dobell-Brown, was also the senior medical officer on the Wing Headquarters. This M.C.S., which had come up from Townsville, landed with other ground forces, and was operational within four to five hours. The site allotted was just within the perimeter and so close to the Japanese line that patients had to be treated in a dug-out with a tent over the top. After two weeks the M.C.S. moved to a permanent site near the beach, where the bed state varied between 80 and 100. A large proportion of the patients were suffering from dysentery, and there were many accidents, the worst when a lift in one of the L.S.T's fell and crushed about ten men, killing some and severely injuring the rest. When the Allies landed the Japanese had hastily moved out of a medical station near the beach, and the M.C.S. was able to make good use of a quantity of surgical instruments and an anaesthetic machine which had been left behind. The line of evacuation was to No. 23 M.C.S. at Nadzab, and thence to Port Moresby and Townsville, but later it became possible to evacuate direct to No. 6 M.R.S. at Merauke. No. 24 M.C.S. did not accompany No. 78 Wing to Aitape, as it had to provide hospitalisation at Cape Gloucester for the R.A.A.F. units which remained there.

In May No. 78 Wing with most of its associated units left Aitape, being replaced there in July by No. 71 Wing. No. 10 Group Headquarters and No. 62 Works Wing with its M.C.S., No. 22, left in the following month. No. 61 was formed in August to replace No. 62 Wing, its M.C.S. being No. 26. After the departure of No. 22 M.C.S. there was for a time no R.A.A.F. hospital at Aitape to take care of the personnel of No. 71 Wing. No. 20 M.C.S. had been formed at Townsville for the purpose but because of a transport delay it was not able to begin operations at Aitape until the end of September. In the interval an army hospital, the 2/7th A.G.H., which had moved into the area with the 6th Australian Division, provided whatever treatment was necessary. No. 71 Wing carried out bombing and attack operations south of Aitape towards Wewak in support of the 6th Division, and this was the position at Aitape during the Wewak campaign and up to the end of hostilities in August 1945.

Hollandia: No. 78 Wing was transferred from Aitape to Hollandia in May. Soon after they arrived the Kittyhawks escorted American Liberators in a bombing attack on Biak; on 17th May they provided air support for an American landing at Arara on the mainland opposite Wakde, and

the next day for a landing at Wakde itself. In the succeeding days they carried out patrols in the Tor River area, during which one aircraft was lost. On 27th May they covered the American landing at Biak. The Americans met stiff resistance on the ground, and were also harassed by enemy aircraft operating from Babo and Sorong. On 3rd June 15 Kittyhawks from Hollandia met 12 Oscars and 3 Kates over Biak; 9 of the enemy planes were destroyed and 3 damaged for the loss of one Kittyhawk and its pilot. On 10th June 8 Kittyhawks chased an enemy plane as it was diving towards Babo, and one of them shot it down. This was the last enemy aircraft shot down by the R.A.A.F. in the New Guinea area.

No. 24 M.C.S. joined its wing at Hollandia in June.

Biak: Biak was not finally subdued by the Americans until the end of June. As soon as an airstrip was made serviceable the squadrons of No. 78 Wing came in. They immediately began to make long overwater flights to targets which they dive-bombed and then strafed. Despite the demanding nature of their duties, the squadron medical officers considered that health was satisfactory, except on one count. A special collapsible rubber dinghy was interposed between the pilot's body and his seat-type parachute pack. As a result of sitting on this for up to four hours pilots began to develop a macular eruption of the buttocks, which was aptly styled "Biak Bottom". Flight Lieutenant N. J. Royle, the medical officer of No. 75 Squadron, designed a satisfactory seat cushion, but hostilities ceased before this design could be considered for general adoption.

No. 1 and part of No. 4 Wireless Units were posted to the island in September. Their work, which was concerned mainly with Japanese codes, was very arduous, and alarming psychological symptoms had been noticed in the men at times when they did not have medical supervision. Normally they did not carry a medical officer on establishment, but one was posted to look after them at Biak, and he kept a close watch for signs of fatigue, and saw that an adequate system of relief was instituted.

No. 24 M.C.S. did not follow No. 78 Wing to Biak, where the wing was to stay only a short time. Hospitalisation for R.A.A.F. personnel was provided by the 41st U.S. Field Hospital until September, when No. 5 M.R.S. arrived from Goodenough to act as the base M.R.S. for No. 10 Group. There was some delay before the M.R.S. began to function, as proper preparations had not been made for its arrival, but by 9th October 80 beds had been equipped. The commanding officer was Wing Commander C. P. Ley, later replaced by Wing Commander S. F. Reid; the surgeon, Squadron Leader J. F. Ziegler, later replaced by Squadron Leader M. H. B. Robinson; and the physician, Squadron Leader J. R. McCoy, later replaced by Squadron Leader A. G. R. Uglow.

In January 1945 No. 62 Airfield Construction Wing arrived on the island, its units moving into excellently prepared camp sites between the Mokmer strip and the sea. Particular attention had to be paid to hygiene and sanitation, as the fly problem on the southern side of the island was becoming troublesome because of the large numbers of American camps

which had been occupied and then quickly abandoned. No. 22 M.C.S., now commanded by Squadron Leader A. W. Raymond, accompanied the wing. It rapidly took over hospitalisation for all R.A.A.F. personnel on the island, leaving No. 5 M.R.S. free for its next move.

Biak was the main base for American transport squadrons in this area, and a detachment of No. 2 M.A.E.T.U. was stationed there, its nurses being accommodated at the M.C.S.

Noemfoor: On 20th June No. 10 Group Headquarters and No. 62 Works Wing had sailed from Aitape for the landing at Noemfoor, which was planned for 2nd July. A few days later they were off-loaded at Tum on the mainland opposite Wakde Island; the place was dirty, the weather wet, the food poor and there were multitudes of mosquitoes. After a miserable few weeks their equipment was reloaded, and they went on to Noemfoor. The Japanese, who were demoralised by the preliminary air and sea bombardment, offered little resistance. The main Allied casualties occurred when 1,400 paratroopers were dropped on Kamiri airfield; the aircraft were flying too low at the time, and some of the parachutes had not opened completely by the time the men reached the ground. There were more than 100 casualties, including 5 men with broken backs and about 20 with broken legs.

The advance party of No. 62 Works Wing went ashore half an hour after the first infantry landed and quickly set to work to make the Japanese airstrips serviceable. During the first four days conditions were difficult, mainly owing to the lack of fresh water, but this problem was solved when wells were dug, and thereafter Noemfoor proved to be a pleasant spot, cool at night and with few mosquitoes.

The first R.A.A.F. medical unit arrived on the 8th July. This was No. 23 M.C.S. under Squadron Leader McGlynn, which had been brought up from Nadzab by sea to rejoin its wing, No. 77. The coral reefs surrounding the island made it impossible for an L.S.T. to approach close to the shore and all the unit's equipment had to be off-loaded into ducks and the smaller L.C.M's and then discharged on the beach. The site allotted was for a time outside the perimeter, and before the M.C.S. could be set up the medical staff had to borrow a bulldozer to clear away shells and mountain guns as well as the bodies of dead Japanese. All this delayed the opening of the unit, which, however, became operational on the 11th. No. 22 M.C.S. under Squadron Leader Dobell-Brown arrived to rejoin No. 62 Works Wing a few days later. It too was situated outside the perimeter. To prevent infiltration by the Japanese the hospital area was surrounded by booby traps, and there were many false alarms when these were set off by animals, while at night an American unit in the rear provided intermittent illumination by firing flares.

Medical work was moderately heavy, and in their first few weeks in the area the bed strength of each unit was about 85. Patients included all Australian Army and Navy sick and many Dutch as well. Dermatological conditions were a problem, and responded only slowly to treatment,



(*R.A.A.F.*)

Flight Lieutenant F. W. Kiel watches his orderly, Sergeant M. D. Hayes, syringing a patient's ear. Northern Area, 1944.



(*R.A.A.F.*)

A native giving minor medical treatment at a medical receiving station in New Guinea under the supervision of an R.A.A.F. medical orderly, Corporal F. Blackmore. Sergeant W. Leavy is in the background.



Likely breeding ground for mosquitoes.



(*L. E. Buley*)

Experimental D.D.T. spraying from an Australian-built Beaufort at Laverton, June-July 1944. D.D.T. in oily solution was contained in two outer wing tanks each of 91 gallons capacity and in an auxiliary bomb-tray tank of 138 gallons capacity.

but there was no scrub typhus and little primary malaria or dengue fever. No. 23 M.C.S. was situated close to the eastern end of the Kamiri strip and all Australian and many American strip casualties were brought in. They included numerous burns casualties from aircraft and petrol accidents. When No. 5 M.R.S. arrived at Biak late in September the position eased, for many dermatological patients who required a long period of treatment and would have crowded the medical clearing stations, could be sent there.

The line of evacuation was through Merauke to Townsville and thence to Brisbane. A Hudson air ambulance unit had begun to operate about a month after the landing, and each ambulance plane brought forward a supply of fresh foodstuffs and Red Cross comforts for the patients at the hospital units.

In October the Australian Red Cross Society appointed a representative to the Headquarters of No. 10 Group. This was Mr R. F. P. Staines, the Deputy Assistant Commissioner, who became the first and only Red Cross officer to serve with the R.A.A.F. Previously Red Cross officers had been attached to the A.I.F. only, and this made it difficult for the society to aid the air force, which often served in areas where the army was not represented at the time: for example, at Goodenough, Kiriwina, Cape Gloucester, Aitape, the Admiralties, Hollandia and Noemfoor.

The squadrons of No. 78 Wing had begun to move into Noemfoor on 18th July, and on the 21st went into action, strafing Japanese barges and cooperating with American patrol boats in Geelvink Bay. Kittyhawks of the wing also took part in the air attacks preceding the landing at Sansapor, and provided fighter cover for the actual landing on 30th July. During August Kittyhawks from the three squadrons patrolled over Sansapor. In these operations four aircraft were lost, two as the result of an accident.

The headquarters of No. 77 Wing which controlled Nos. 22 and 30 Squadrons had been at Noemfoor since 12th July. The Beaufighters of No. 30 Squadron arrived on 4th August and the Bostons of No. 22 Squadron on the 10th and 11th. At the end of August Air Commodore Cobby, who had taken over the command of No. 10 Group from Scherger, ordered an all-out attack by his Kittyhawks, Bostons and Beaufighters on forward Japanese airfields at Babo, Mongosah, Sagan and Otawiri. In these operations one Kittyhawk pilot was lost when his plane was hit by anti-aircraft fire and crashed into the sea.

In the operations in the Dutch New Guinea area the morale of all the Australian pilots was high. For this the activities of the Catalina air-sea rescue service were partly responsible. This service was operated mainly by the American Navy and to a smaller extent by the R.A.A.F. Aircrews were convinced that if they made a crash landing in the sea or near the coast they would be picked up by the flying-boats.

CHAPTER 27

MOROTAI, THE PHILIPPINES AND BORNEO

IN the advance through the Philippines No. 10 (Operational) Group R.A.A.F., under Air Commodore A. H. Cobby, was allotted to the American Thirteenth Air Force, which played a supporting role only in these operations. Subsequently the name of No. 10 Group was changed to First Tactical Air Force, R.A.A.F., which was more descriptive of its intended function as an independent, self-contained task force. Group Captain C. J. N. Leleu became its Principal Medical Officer.

Morotai Island, lying midway between New Guinea and Mindanao, had been selected as the base of operations against the Philippines. On 14th September an American task force made an unopposed landing there. No. 10 (Operational) Group, as it was still called, provided air cover for the landing, and No. 61 Airfield Construction Wing went ashore four days after the first wave. By the beginning of October the wing had become well established. Hygiene in the camps was good, largely because of the efforts of Sergeant E. R. Coe, the hygiene inspector attached to the wing, and a minor outbreak of bacillary dysentery in No. 3 Airfield Construction Squadron was quickly brought under control.

The intention was that No. 20 Medical Clearing Station should be used with the wing, but this unit could not be brought from Townsville in time and No. 26 M.C.S., which had been serving No. 71 Wing at Tadji, was used instead. Squadron Leader J. Hall-Johnston became senior medical officer of the wing and commanding officer of No. 26 M.C.S., replacing Squadron Leader J. F. Hughes, who had fallen ill. Flight Lieutenant J. B. Maloney was the unit's surgeon.

The incidence of disease on Morotai in the period after the landing was low. The weekly rates per 1,000 for malaria, dysentery and dengue were 1.6, 2.5 and 4.1 respectively, and soon the figures for dysentery and dengue were further reduced; the average bed state of the M.C.S. was about 20. All evacuations were direct by air to No. 5 Medical Receiving Station at Biak.

At the end of December No. 23 M.C.S. arrived under the command of Squadron Leader Adrian McGlynn. It quickly took over the patients of No. 26 M.C.S., which moved to another part of the island. The sickness rate continued to be low, but air raids were common, and on several occasions bombs fell unpleasantly close to the hospital area, fortunately without causing damage.

The first phase of the Philippines operations, the landing at Leyte, was scheduled to take place on 20th October. As a prelude, R.A.A.F. operations from Darwin against the Netherlands East Indies were intensified, and Leyte Island was subjected to a "softening up" process by a strong bomber force in which R.A.A.F. units were included. When the Americans had established a beach-head R.A.A.F. units helped to provide air cover.

In the course of the operations several Australian aircraft and their crews were lost.

In the second phase, the landings at Luzon and Mindoro, one R.A.A.F. unit, No. 3 Airfield Construction Squadron, was to take a more direct part. At the end of November the squadron, approximately 550 strong, including attached members, left Morotai for Leyte where it was to stage on its way to Mindoro. It was not considered practicable to send the whole or part of No. 26 Medical Clearing Station, but a unit medical section went along. It consisted of a medical officer, Flight Lieutenant J. D. Connellan and five medical orderlies, with Sergeant Coe attached as hygiene inspector. Medical supplies for 90 days were taken. Connellan formed a unit sick-quarters for the minor sick, and when any men became seriously ill used American facilities to evacuate them back to No. 26 M.C.S. at Morotai or to No. 5 M.R.S. at Biak. At Leyte the camp was situated on a sand spit between the Bisling River and the sea. The men, with only a few exceptions, bathed in the river and their clothes were washed there.

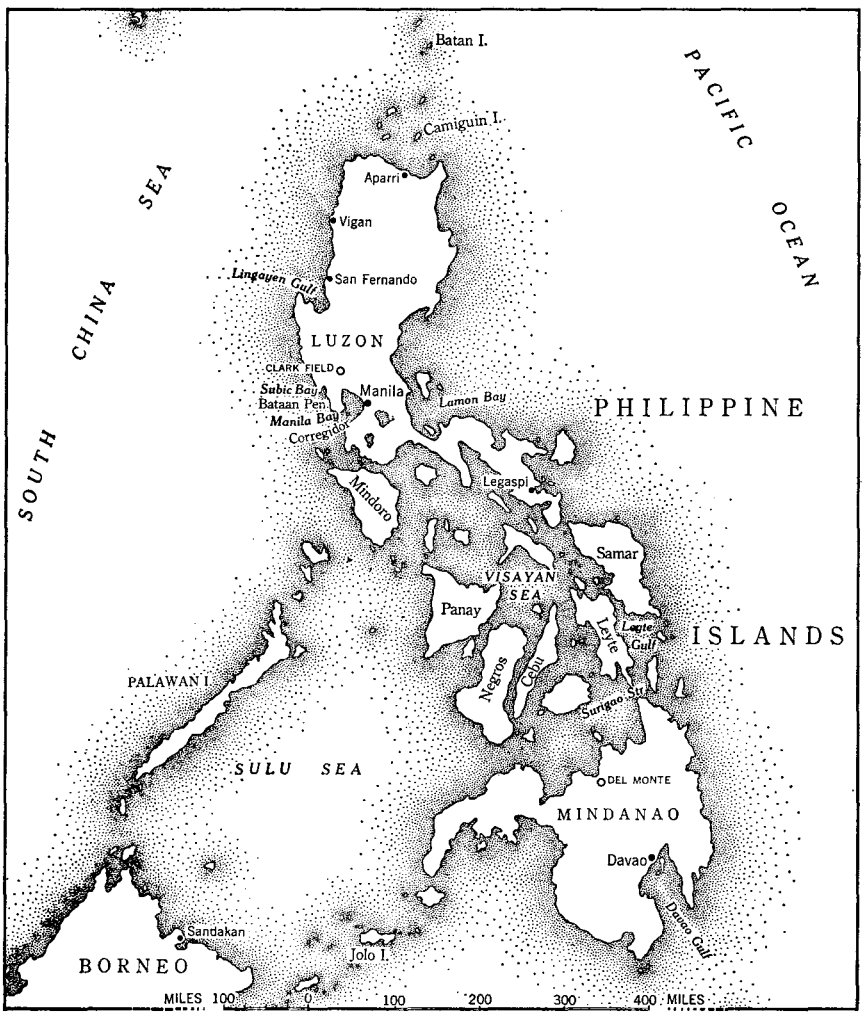
Leaving Leyte for Mindoro on 10th December, the construction squadron went in with the first assault wave on the 15th. Enemy aircraft were met with heavy anti-aircraft fire, but one made a suicide dive into the rear of an L.S.T. containing Australians, and then, as the unit laboured to unload its equipment on the beach, a second crash-dived at the open door of another L.S.T., killing one man and badly injuring several others. The unit established a temporary camp and the men immediately began work. As enemy paratroopers were expected, they also had to man 2,500 yards of perimeter. By 19th December, however, the first airfield was completed. On 26th December the unit came under fire again when a Japanese naval force attacked Mindoro, but there were no casualties, apart from a few cases of "shell shock".

From about 24th December onwards numbers of men developed an illness with symptoms including fever, general malaise and weakness, aching pains in limbs and joints, neck stiffness, cough, urticaria and diverse disturbances related to the gastro-intestinal tract, liver and spleen. Fever was remittent in type, the body temperature being if anything only slightly elevated in the mornings and rising to 101 or 102°F. by evening; the usual duration of the fever phase was 5 to 7 days. The daily rise of body temperature was accompanied by malaise, weakness, aching joints and limbs, and in some 75 per cent of cases by neck stiffness. Cough, a frequent symptom, was harsh and unproductive in type. Urticaria, which did not occur in all cases, was sometimes severe. Gastro-intestinal symptomatology consisted usually of diarrhoea and upper abdominal aching, while tenderness in the region of a slightly enlarged liver was common. As the strip was being bombed a good deal, many men remained on duty who under other circumstances would have "gone sick".

In the early stages of the outbreak the disease was thought to be a dengue-like fever. By the end of January, however, it was realised that

it was due to infestation by *Schistosoma japonicum,* of which the Americans in the Philippines had already had some hundreds of cases.

Schistosomiasis[1] is a disease caused by invasion of man by blood flukes of the family *Schistosomidae.* Three species are well-known: *Schistosoma*



mansoni, S. haematobium and *S. japonicum.* While *mansoni* occurs in western Asia and in Africa, and *haematobium* in Africa and South America, *japonicum* is confined to the Far East, being endemic in parts of Japan, China, Formosa and the Philippines. In the First World War an appreciable number of cases of the disease (then called Bilharziasis),

[1] The mechanism and symptomatology of the disease are also discussed in *Clinical Problems of War,* the first volume in this series.

were diagnosed in Australian soldiers serving in Egypt, and there is reason to believe that infestation of a small number of Australian soldiers occurred in the South African War. *S. mansoni* predominated as the cause of First World War cases.

The parasite has a complex natural life cycle. The adult forms inhabit the portal veins and tributaries of humans, depositing their ova in the hollow internal organs, and escaping in the urine or faeces. In contact with fresh water a larval free-swimming form—*miracidium*—emerges, and invades the molluscan intermediary host, a fresh-water snail appropriate to its species. In the snail a worm-like form develops, and this has the ability to penetrate intact human skin and proceed to the portal system, where the adult *Schistosomulae* again mature. The disease is thus endemic only in areas where a suitable intermediary host exists.

It was apparent that most of the men of No. 3 A.C.S. had been exposed to the risk of infestation. In February, a memorandum was issued by the D.G.M.S., R.A.A.F., setting out the then favoured methods of investigation and treatment. In view of the mode of transfer of the disease from person to person, the outbreak was one which potentially concerned the Australian public health authorities, and the D.G.M.S. notified the Director-General of Public Health of the occurrence of the disease and of the measures proposed for its control. The latter were at this early stage considered to be adequate.

Flight Lieutenant Connellan was instructed by the P.M.O., Group Captain Leleu, to commence a clinical survey of the unit, and to carry out white cell counts on all personnel. A laboratory technician was sent to help and on 7th February he commenced stool examinations by a simple smear method, and white cell counts. All men having an eosinophilia of 10 per cent or higher were arbitrarily considered to have schistosomiasis, and their treatment with Fouadin was initiated by Squadron Leader A. G. R. Uglow of No. 5 M.R.S. who arrived at Mindoro on 28th February. Fouadin, a synthetic trivalent compound containing 13.4 per cent antimony, was administered intramuscularly in 9 injections given on alternate days, the course totalling 40 millilitres. Little toxic reaction to the drug was noted. To this date schistosome ova had been found in stool examinations of only 3 cases. Fouadin was administered to 177 men. Uglow apparently intended to give further treatment to those whose eosinophilia remained high—the eosinophil count was thought at this time to be a guide to cure—but he was recalled to his own unit on 4th April, and two weeks later the laboratory technician also left.

At the beginning of April there remained 56 cases with eosinophilia of 10 per cent or higher who had not been treated, the reason being that the original supply of Fouadin had been exhausted and a further consignment lost in transit. Group Captain A. H. Baldwin, Director of Hygiene and Tropical Medicine, who arrived at Mindoro on about 20th May, advised the P.M.O. that tartar emetic, which had been used to treat cases during and after the First World War, was more satisfactory, and it was decided to treat the remaining cases with this drug. After investigating

the 56 untreated cases, Baldwin decided that only 41 had signs or symptoms suggestive of schistosomiasis. As an American Commission on schistosomiasis headed by Dr E. C. Faust had arrived in the Philippines and had sent a party to Mindoro, it was decided to have these 41 cases investigated by the Commission, together with 42 of those already treated.

In each case the Americans examined two stool specimens using a sedimentation technique, and also performed a sigmoidoscopy. Pinch biopsies were made of the lesions seen in the lower bowel, and ova demonstrated in the biopsy material. No pathognomic bowel picture was found, however, and no correlation of bowel appearances with excretion of ova established. They found 10 men excreting ova in their stools among the 41 untreated cases and 4 among the 42 treated cases. Treatment was instituted in the 14 positive cases. In the negative cases it was considered that the men treated with Fouadin had been cured and that, if infestation had in fact occurred in the untreated cases, the parasite had failed to complete its life cycle.

No. 3 A.C.S. was transferred from Mindoro to Morotai on 8th June. Treatment was interrupted as a result, but it was resumed at Morotai on 27th June with tartar emetic, administered intravenously. Tartar emetic is, like Fouadin, an antimony-containing compound. At first the compound was given on alternate days on an increasing dose scale ranging from 3 to 10 millilitres, a supply of 1 per cent solution being freshly made on each occasion. As toxic symptoms observed were minor, a more intensive course was tried, injections being given daily with a rest each seventh day. A total of two grammes of the emetic was administered to each individual in a series of 22 injections over a period of about three weeks and a half.

Hurley visited No. 3 A.C.S. at Morotai in June and after consultation with Group Captain Baldwin and Brigadier N. H. Fairley, consultants in tropical medicine, recommended the withdrawal of the entire unit to the mainland of Australia for investigation and treatment.[2] It was realised that as well as safeguarding the health of members of the R.A.A.F., a valuable contribution could be made to the limited knowledge of this disease by a thorough and well-controlled investigation. The R.A.A.F. station at Somers, Victoria, was chosen as the most suitable site for the investigation, which was to be carried out as a research project under the control of Squadron Leader W. P. H. Dakin by the R.A.A.F. medical service in cooperation with the School of Tropical Medicine in Sydney and the Walter and Eliza Hall Institute in Melbourne. Dakin had already joined No. 3 A.C.S. at Morotai after spending some weeks studying schistosomiasis infestations at the 118th American General Hospital at Leyte.

No. 3 A.C.S. left Morotai on 8th July for Balikpapan where some necessary work had to be completed. As soon as the unit had established its camp a small laboratory was built and further cases reviewed by stool

[2] The account of the investigation which follows is based largely on an article in the *Medical Journal of Australia* of 1st March 1947 by Sqn Ldr W. P. Dakin and F-Lt J. D. Connellan.

examinations, using sedimentation technique, and blood counts. In the space of the next three weeks a further 19 cases were found to be excreting ova in their stools. The 19 new cases were evacuated by air to Victoria, and reached Somers on 14th August, preceded on the 13th by Dakin, who went to arrange laboratory facilities. Treatment of the 19 cases with tartar emetic was begun at Somers on 30th August. The remainder of the unit moved by air from Balikpapan and by 20th September most of the men had arrived at Somers. Those who had been transferred to other units or discharged from the R.A.A.F. were traced by the Directorate of Postings and the repatriation authorities and posted back for investigation.

In due course an appraisal was made of findings throughout the outbreak and its follow-up, in terms of methods of diagnosis and of results achieved with Fouadin and with tartar emetic.

The symptoms of the disease have already been discussed. There was, however, a striking absence of any clear-cut clinical syndrome. Observations were made on the course of the disease over a twelve months' period, based on a series of 139 patients, of whom 103 had had unsuccessful Fouadin therapy, and 36 had been missed at previous examinations. Of these men 125 were still excreting ova ten to twelve months after infestation, and 14 had apparently been cured by treatment with tartar emetic some six months and a half after infestation. Yet no symptoms at all were felt by 108 of the men; they seemed fit and had been doing hard physical work in a tropical area when their condition was diagnosed, and they would probably have been free from symptoms for many months more. Apart from ova in the stools, only 8 had physical symptoms: five had tender and enlarged livers, one had tenderness in the epigastrium, and two tenderness over the spleen. Mild symptoms were felt by 31 of the men, but were probably not related to schistosomiasis. Lassitude was the commonest complaint; abdominal and rheumatic pains and headache were also frequent. After the initial febrile attack the patients usually felt quite well. The danger lay in regarding them as cured, for in fact a process of tissue destruction was going on which, if unchecked, could eventually result in death.

Once it has been established that there has been exposure to infestation, the diagnosis of schistosomiasis depends almost entirely on laboratory investigations. The clinical course of the disease falls into three stages: the initial febrile illness, the latent stage, and the stage of visceral damage. In an infested area any case of febrile illness should be suspected of schistosomiasis. Positive results to the complement fixation, or Fairley, test will reveal the presence of *Schistosoma* infestation before ova are found in the faeces, and careful and repeated stool examination will enable a definite diagnosis to be made once ova are present in sufficient density to be demonstrable microscopically. The latent stage is the most difficult to diagnose; stool examinations and the complement fixation test were used at Somers for this stage. The stage of visceral damage presents no diagnostic difficulties. As the ova are not easy to find, sigmoidoscopy

and the complement fixation test will establish the diagnosis when the patient is in an endemic area or has a history of exposure to infestation.

The complement fixation test was a quantitative one, using as its antigen a preparation from the livers of the snails *Planorbis exustus* infested with *Schistosoma spindale*. It was carried out for the Somers trial by F. E. Williams of the Walter and Eliza Hall Institute. The results of the test were compared with stool examinations and blood counts in all 560 of the men investigated. Most of the tests were made between ten and twelve months after infestation. The complement fixation test was positive in 169 cases, 139 of which were passing *Schistosoma* ova in the stools; 144 had passed ova at some time or other; only 5 patients in whose stools ova had been found gave a negative complement fixation test. There appeared to be nothing unusual about these 5 cases, and no reason could be found for the failure of the test. Four of the subjects had had early unsuccessful treatment with Fouadin, and one was untreated; all were excreting ova at the time of the test. On the other hand, 8 men gave a positive reaction to the Fairley test, although they had not been regarded as suffering from schistosomiasis and no ova were ever found in their stools; they had, however, been exposed to infestation. There are three possible reasons for the positive reaction: (*a*) the body had been invaded by worms which had failed to mature but were sufficient to provoke a humoral response on the part of the tissues; (b) only one sex of the worm had developed or survived in the body; (*c*) the mature worms had died spontaneously.

The value of the Fairley test is indisputable. It is a delicate test, and discloses a number of cases that might otherwise be missed—particularly those in the later stages of the disease when ova are increasingly difficult to find. It is also an easy test to perform—far simpler than the laborious stool examinations.

Stool examinations were at one stage unreliable, but when the smear was replaced by the sedimentation method, they provided an important source of information. As a routine diagnostic procedure sigmoidoscopy was regarded as unwarranted; its main use was in the later stages of bowel damage when ova were scarce.

A high eosinophil count is almost invariable in cases of schistosomiasis, with a definite increase in the early stage of the disease. As it falls later, even when ova and living worms are present in the stools, it cannot be used as an indication of cure. Nor does a high eosinophil count necessarily mean that schistosomiasis is present; eosinophilia accompany a number of other parasitic diseases, and other diagnostic methods must therefore be used in conjunction with the eosinophil count. However, if a large group has been exposed to schistosomiasis, the eosinophil rate will give a rough clue to the possibility of infestation.

The white cell count was little used in this series because it was not considered helpful enough to justify subjecting the patient to a further series of needle-pricks in a disease where so many injections were neces-

sary. The risk of setting up a schistosomiasis complex was to be avoided if at all possible.

Fouadin—the treatment first used—was, as mentioned, given to 177 patients; 103 relapsed, and ova were detected in the stools. As the only indications for treatment had been simply eosinophilia and symptoms, it is possible that not all these patients had actually contracted schistosomiasis, and that even this high relapse rate of 58 per cent was a conservative estimate. In view of the poor results it was decided to treat any new patients, as well as those who had relapsed, with tartar emetic. In none of the 139 patients treated was it found necessary to suspend treatment because of toxic effects of the drug, though there were a few unpleasant side-effects, both immediate and delayed; the most serious were the rheumatic pains which developed in the evening after an injection. In the main the patients were treated as out-patients and put to bed only when the pains became severe. By treating them as reasonably healthy men and reassuring them about the prognosis, a good outlook was maintained. This was in contrast with treatment in other units, which had looked on infested men as outcasts whose future was likely to be unpleasant and rather brief.

In the course of investigations at Somers infestation with other parasites was found in a number of cases, as follows:

Number investigated .	240	
Trichuris . . .	4	(1.66%)
Ascaris . . .	10	(4.15%)
Hookworm . .	13	(5.4%)
E. Histolytica . .	2	(0.83%)

Three patients had double infestations, two with *Ascaris* and *Trichuris,* and one with *Ascaris* and hookworm.

During January 1945 Nos. 4 and 6 Wireless Units were required to continue their special task of intercepting Japanese radio transmissions in the Philippines area. Moving from Biak to Leyte, they were accommodated in Tolosa, and the medical section was housed in an unused school room.

The units were under the administration of Northern Command and at first had no medical personnel or medical stores, sick parades being conducted and hospitalisation provided by the 118th American General Hospital about a mile and a half away. However, at the end of January Flight Lieutenant L. J. Ray with two medical orderlies was sent to take over the medical arrangements for the R.A.A.F. in the area. He also provided medical care for the 125th American Signals Unit, on which No. 6 Wireless Unit was based for supplies, and, while attempting to trace R.A.A.F. personnel under treatment at American medical establishments and those who were evacuated through American channels in the Philippines, acted as R.A.A.F. medical liaison officer with the United States Army Services of Supply bases at Leyte.

A survey in May 1945 of all the personnel of No. 6 Wireless Unit revealed no case of schistosomiasis.

The next task for the Australians was the occupation of three areas in Borneo. For the purpose First T.A.F. was placed under R.A.A.F. Command's direct operational control, and its strength at Morotai gradually built up. In November 1944 No. 77 Wing Headquarters (Operational Detachment) had moved in, followed later by its medical clearing station, No. 23. The "B" Echelon of First T.A.F., No. 78 Wing Headquarters and its operational units, arrived from Noemfoor, and an advanced party of No. 80 Wing and the air echelon of one of its squadrons, No. 452, from Darwin. No. 23 M.C.S. had to provide medical care not only for the men of its own wing but for those of No. 78 Wing, whose medical clearing station, No. 24, was left behind at Noemfoor.

During February 1945 No. 5 Medical Receiving Station, which was the Base Hospital for First T.A.F., was moved from Biak into Morotai, and quickly became operational under Squadron Leader S. F. Reid. The experiment of having a medical receiving station in the rear, as at Biak, had been a failure, and it was decided by Leleu that in future medical receiving stations should move in relation to Command headquarters, which was usually in the area where there was the greatest concentration of personnel.

No. 27 Air Stores Park had at first been responsible for medical stores at Morotai, but the service was not completely satisfactory until No. 25 Air Stores Park arrived late in March. No. 25 A.S.P. eventually became the main medical group base store for the First T.A.F., holding reserves of penicillin, sera, vaccines and other stocks that it was not desirable to duplicate in all air stores parks.

In March No. 81 Wing arrived on the island, followed later by its M.C.S., No. 28, under Squadron Leader A. G. McManis, who was also the Senior Medical Officer of the Wing. The remaining part of No. 80 Wing had difficulty with transport, but was completely assembled in April, although its M.C.S., No. 25, under Wing Commander I. H. Cuming, did not become operational until some time afterwards because of the non-arrival of essential equipment from Darwin. By the end of that month First T.A.F. numbered 16,894 men.

At this time Hudsons from No. 2 Air Ambulance Unit provided a fortnightly air ambulance service between Morotai and Brisbane, and in May No. 34 (Transport) Squadron and No. 2 Medical Air Evacuation Transport Unit arrived on the island.

The incidence of malaria at Morotai increased slightly during April and May. Most of the cases occurred in units which had moved from the Nadzab-Lae area; many of these men were already infected and their atebrin discipline was poor. Other cases were new arrivals from non-malarious areas, who were unaccustomed to anti-malaria discipline. And some of the old hands had the unfortunate habit of telling the new hands that there was no malaria on Morotai.

There was also an increase in bowel diseases, about 10 per cent of the cases being diagnosed as bacillary dysentery. To combat this epidemic a vigorous hygiene campaign was opened, mainly in No. 81 Wing (from Darwin), which had the highest incidence. The rains had become very heavy and there was considerable surface pollution of water holes, wells and bores. The main R.A.A.F. water point, which had previously been considered practically sterile with less than 100 colonies per millilitre and no *B. coli,* now had 2,000 colonies per millilitre and a considerable number of *B. coli.* When a chlorine injector was established, the number of cases decreased steadily.

Tarakan, an island off the north-east coast, was chosen as the first of the Borneo objectives in the belief that it would provide airfields from which air cover could be supplied for later operations at Brunei Bay-Labuan Island and Balikpapan. It was also a potentially valuable oiling station.

The Deputy Principal Medical Officer, Squadron Leader D. J. Dowling, was responsible for medical arrangements at Tarakan. Medical planning for the landing was based on detailed information about climatic conditions and terrain. Rainfall was about 11 inches a month; temperature (shade) between 80 and 90°F. and humidity between 80 and 85 per cent. From aerial photographs the island appeared to be well drained, but depressions, for instance bomb craters, had been filled by the rains. The soil was a clay loam, which would permit easy construction of deep trench latrines and wells.

The prevailing winds for the first few weeks of the operation were expected to vary between north-east and north-west. When the wind was from the north-east the breeding grounds favourable to *Anopheles minimus* were directly to windward of Lingkas and Tarakan town. Indications were that mosquitoes would be numerous, the main species of anopheline on the coastal area being *A. sundaicus* and *A. kochi,* with a possibility of *A. minimus* and *A. macalatus* in the foothills. It was feared that *A. kochi,* although not usually an efficient vector if subjected to normal larvae control, would adopt the breeding habits of *A. punctulatus* and begin to breed in wheel ruts, artificial pools and even tins and bottles. *A. kochi* differed from *A. punctulatus* in that it did not leave a building after biting, a circumstance which made it easier to destroy. Although the sporozoite rate was low, this mosquito in sufficient numbers could become a danger. A part of No. 3 Section of No. 2 Malaria Control Unit under the command of Flying Officer G. J. Snowball, was to go in on the assault convoy, the rest of the section to follow with additional transport and supplies of D.D.T. and kerosene. Each unit was equipped with enough reserve atebrin for seven days' suppressive use and with mosquito repellent on the basis of one 4-ounce bottle per man.

It was anticipated, in view of the probable prevalence of flies, that dysentery both bacillary and amoebic would present the greatest problem. Prefabricated latrine seats were provided, and units were told that deep-trench latrines must be in operation within 48 hours of the camp sites

being occupied; in the meantime shallow trenches, strictly supervised by hygiene inspectors, could be used. Other precautions against dysentery included the issue of water-sterilising outfits, and units were forbidden to use water for drinking, cooking or washing unless it was rain water from catchment areas or had been previously chlorinated.

The degree of stringency necessary in carrying out anti-mite precautions was to be gauged from a survey of the area and the presence or otherwise of scrub typhus among the local inhabitants and enemy forces. Units were instructed to clear camp areas thoroughly, especially round the tents. Personal protection was given by issuing one ounce of mite-repellent to each man. The army had stressed the risk of Asiatic schistosomiasis; the R.A.A.F. medical authorities considered this unlikely, but expected *Ascaris* and *Ankylostoma,* and snail surveys were planned. Typhus was not considered a danger, nor were leptospirosis and plague, but the necessity for rat control was stressed at briefing conferences.

The low standard of hygiene during the Japanese occupation, and the fact that epidemics of cholera had occurred at Macassar in March 1944 and at Kobe and Osaka in Japan, points of supply and reinforcement, made cholera a possibility. However, it was expected that the situation would be taken care of by the control methods exercised against dysentery and by the fact that all R.A.A.F. troops committed to the operation had been inoculated against the disease.

It was not possible to provide a medical clearing station for the landing, but it was thought that R.A.A.F. casualties would be negligible. The size and scope of the Medical Section of No. 1 Airfield Construction Squadron in the assault convoy was increased by one medical officer—Squadron Leader J. Hall-Johnston of No. 26 Medical Clearing Station—and two orderlies with theatre experience, as well as additional equipment, including serum.

Units were instructed to set up sick-quarters on the basis of eight beds to each flying squadron, and to hold all minor surgical or medical cases until the arrival of the medical clearing stations. In the meantime the army was to admit urgent R.A.A.F. cases to the 110th Casualty Clearing Station. The estimated requirement was for 140 hospital beds, which was easily covered by three medical clearing stations.

The briefing of personnel of the medical branch was done on a wing basis, and covered the medical, hygiene and malaria control aspects. As well as medical personnel, pharmaceutical officers from the air stores parks attended.

The landing at Tarakan took place on 1st May. The 26th Brigade quickly established a beach-head, there being little opposition as the main body of the Japanese had withdrawn a short distance inland. Small parties from the various R.A.A.F. units were brought ashore and after some initial confusion collected at the end of a pier; only one R.A.A.F. casualty was sustained in the landing. During the night the near-by beach was shelled, and there were a few uncomfortable minutes until artillery

silenced the enemy's 75-millimetre guns. Snipers were active in the area, and the men did not move from the camps.

Unit medical arrangements were at first inadequate. On disembarking units formed temporary camps where it was impracticable to set up more than an emergency aid post, but as they gradually moved into permanent sites standard R.A.A.F. medical sections were set up and these were soon functioning smoothly. Meanwhile, the army took care of R.A.A.F. sick and wounded. During this period 79 members of the R.A.A.F. were sent to hospital. These hospital admissions consisted of 14 men wounded accidentally or in battle; 13 other surgical cases; 12 cases of diarrhoea, 38 other medical cases and 2 mental cases. Seventeen men were evacuated. Apart from one evacuation by air, the army handled all evacuations, sending patients to Morotai by sea.

Nos. 1 and 8 Airfield Construction Squadrons had gone ashore on the day of the landing but were unable to begin work until the airfield was taken on 5th May. It had been seriously damaged, was waterlogged, and littered with mines and booby-traps. In addition, work was hampered by heavy rain, by enemy shelling and air raids, and by the infiltration of parties of Japanese. Between 5th and 31st May Japanese raiding parties killed two men and seriously injured another. The airfield construction squadrons were at first scattered in buildings all along Anzac and Collins Highways, and hygiene control was difficult for this reason; No. 8 A.C.S. had prepared incinerator latrines but under pressure changed to deep-pit types. Later the squadrons established themselves entirely under canvas.

Units of Nos. 77 and 78 Wings were sited both in houses and under canvas. Hygiene was good, but subsoil water was only two feet below the surface and there was difficulty in building latrines. Fortunately Squadron Leader G. F. Salter was able to advise on the construction of the built-up type.

No. 28 M.C.S. was the first medical unit to function. The greater part of its personnel arrived on 7th May. At Morotai the unit had used masses of telegraph wire left behind by the Japanese to put up mosquito nets. Arriving at Tarakan at night and seeing telegraph wire lying around, they promptly commandeered it for the same purpose. In the morning an irate army officer arrived to inform them that they had pulled up the line of communication between the artillery and the front line. The medical and surgical wards of the M.C.S. were established in a series of slightly damaged buildings, which were made habitable only after a considerable amount of work; other sections and living quarters were under canvas. No. 28 M.C.S. was ready to receive patients on 16th May, and admissions increased rapidly until there was a daily bed state of about 35. The enemy line was very close and at night the Japanese would creep up and throw hand grenades. This created an atmosphere of tension, and some men were shot in mistake by their own side.

As mentioned, Squadron Leader Hall-Johnston, the commanding officer of No. 26 M.C.S., had come ashore with No. 61 Airfield Construction Wing in the early days after the landing, but his unit's equipment did

not arrive until the 16th. This unit too was accommodated both in houses and under canvas. It began receiving patients on 21st May and the daily bed state was about 12. This low figure was probably due to the fact that the unit was servicing two A.C.S's which were new arrivals from the south. No. 28 M.C.S. with its comparatively high figures was serving two wings. In the early days most of the personnel of No. 26 M.C.S. contracted diarrhoea.

No. 23 M.C.S., now commanded by Squadron Leader R. G. Weaver, also suffered from a piecemeal move. Some men arrived on 7th May, others on the 18th, and the rest on the 22nd; the equipment came ashore on the 23rd. No effective work could be done in preparing the camp site until the equipment arrived, and for the first few days the front line was uncomfortably close. The situation on the first evening was particularly tense because the enemy kept up a barrage of small-arms and mortar fire. This M.C.S. occupied a portion of the former oil company hospital, which must have been modern and pleasant before the Japanese attempted to demolish it. The walls and floors were intact but the roofing was gutted and a considerable amount of work was necessary to put it in a state of repair. When operational it was an ideal site, even having a sanitary system and being connected to the town water-supply. Part of the hospital was occupied by the army as a divisional rest centre.

For the first 48 hours after the landing units depended for water on supplies that they or the army had brought in; unit bulk supplies were in most cases still on board ship, but there was ample water for drinking purposes. The army set up a water point with two large underground tanks which Squadron Leader Salter had found; this water was chlorinated, as was water drawn from local streams. In several instances the chlorination broke down, and this may have been the cause of some diarrhoea. A few units were able to supplement their supply by local underground and overhead concrete tanks, the water in which was found to be suitable for drinking after chlorination; other units dug wells from which they obtained an adequate supply for washing although their drinking water had to be carted. Later the army repaired the local water-supply, which was filtered and chlorinated, and reticulated to points throughout the island.

Rations from the army depot were satisfactory, although rather monotonous. There was an ample supply of bread, and later a consignment of fresh meat, eggs, butter and vegetables arrived. These were supplemented with vitamins *B1* and *C*.

With the airfield still in an unserviceable state the Thirteenth American Air Force provided air cover for Tarakan until 15th May, when Beaufighters of No. 77 Wing and Kittyhawks of No. 76 Squadron, which had moved to Sanga Sanga airfield in the Sulu Archipelago, were able to take over the task. On 30th May Weaver, as the Senior Medical Officer of No. 77 Wing, took a medical detachment to Sanga Sanga. This detachment set up accommodation for 30 with all facilities except X-ray, and began to receive patients on 6th June. Squadron Leader G. C. Corlis and

Flight Lieutenant E. W. Gibson remained at Tarakan to look after the rear parties of the wing. The Medical Section of No. 31 Squadron almost came to disaster there when a napalm belly-tank landed within 30 yards of their building and then travelled towards it, emitting burning liquid. Fortunately it was quickly extinguished by Corlis and his staff. A patient who was having his leg plastered appeared to make a miraculous recovery, if the speed of his withdrawal was any indication. The cause of the accident was a smoking fire at No. 23 M.C.S., which the pilot of the aircraft mistook for a smoke marker.

Squadron Leader Dowling and his staff had arrived two days and a half after the landing. Flying Officer Snowball and his party from No. 2 Malaria Control Unit came ashore at the same time, but it was some days before their equipment was unloaded. Surveys revealed very few malaria-carrying mosquitoes, and in fact no cases of malaria occurred on the island in the first few weeks. There was, however, a large culicine population and domestic control was proving difficult. A fever of doubtful aetiology gave some trouble. The army, which had a number of cases, dubbed it "dengue-like fever", but Group Captain Leleu considered the term confusing, and preferred to call it "T" fever. Clinically it resembled sandfly fever, but there was no rash and the post-fever depression was transient only. No phlebotomus flies were present at Tarakan, and it was possible that the disease was transmitted by *Aedes albopictus* which was prevalent, and that normal mosquito control had been ineffective in preventing its spread. The area where the cases occurred was very confined and well away from all other camps. The presumed vectors were not present in large numbers in areas occupied by the R.A.A.F., which did not have any cases. Control was made easier by the extensive layer of crude oil that had flowed over many of the big swamps. D.D.T. in malariol was used, and the reports of the results were most satisfactory. Domestic larvae appeared to be more resistant than anophelines to D.D.T.

Flies were a nuisance. No trace of their breeding grounds could be found, and the only measures that could be taken against them were fly-proofing, spraying of kitchens with D.D.T., and the use of pyrethrum. The disposal of garbage by incineration, using petrol burners, was standard in all units.

The general incidence of disease in air force units was low, the average daily bed state of 47, or approximately 10 per 1,000, being a good indication of health on the island. The only disease which struck large numbers was diarrhoea, but the most serious outbreak, 70 cases in No. 78 Squadron, was rapidly controlled. There were four cases of dysentery to the end of the first month, and possibly a few more which were not correctly diagnosed. The incidence of skin disease was negligible.

Morale was also good, in spite of the facts that the men had to live under primitive conditions for a long time and that it was difficult to relieve those whose tour of duty had expired. The flying squadrons, not having any aircraft, might have been expected to become restless, but

this was avoided by keeping them busy working on the strip and handling supplies and equipment at the waterfront.

Dowling summed up the medical lessons learned at Tarakan. He considered it essential that in future landings the air force should have a medical unit ashore within 48 hours to handle its own casualties. Immediately after the assault at Tarakan the army had established beach dressing stations through which all casualties passed in the process of evacuation to an L.S.T. As the front line advanced, the dressing stations moved up; surgery was performed and patients held until the landing ships departed. These dressing stations were run by field ambulances. Later a C.C.S. was established and complete surgical and holding facilities became available. All early casualties, except minor ones, were evacuated. This idea was sound, as it meant that medical units could concentrate on the job in hand and not have to worry about the holding of patients as the units moved forward.

There is no doubt that if units, particularly medical units, had come ashore as a whole, they would have been set up and have begun to function more swiftly and smoothly. While the prospect of using existing buildings for M.C.S's seemed very attractive at first, experience proved that the effort and time wasted in making repairs was not worth while, and Dowling strongly recommended that where possible M.C.S's should establish themselves under canvas. He also recommended that in future the R.A.A.F. should have an independent water-supply, to be operated by trained men, preferably attached to an airfield construction wing. This was not possible at Tarakan, where arrangements for supply for the first 48 hours were totally inadequate, and in different circumstances could have been calamitous.

Organised Japanese resistance on Tarakan had ended by 15th June. However, because of the condition of the soil and the continued heavy rains the airfield construction squadrons, despite the most strenuous efforts, did not succeed for some time in bringing the airfield into a serviceable condition. This meant that the greater part of the combat strength of First T.A.F. had to be left at Morotai.

Brunei Bay-Labuan. The Brunei Bay area in British North Borneo, with its considerable resources of oil and rubber, was the second objective in the Borneo campaign. The Principal Medical Officer, Group Captain Leleu, was responsible for medical arrangements. However, after the Tarakan operation had been completed Squadron Leader McManis, the commanding officer of No. 28 Medical Clearing Station, was appointed Senior Medical Officer at Tarakan, and Dowling took charge at Brunei Bay-Labuan to allow Leleu to supervise medical arrangements for the next landing.

After an intensive preliminary bombardment by the Thirteenth Air Force and First T.A.F. the 9th Australian Division on 10th June made simultaneous landings on the island of Labuan, which commanded the entrance to Brunei Bay, and near Brunei on the mainland. Air Com-



Dutch New Guinea, Borneo and the Philippines.

modore Scherger established a post ashore on the day of the landing; by the evening the Labuan airfield was taken, and the men of No. 62 A.C.W. began work on it. The forces which landed at Muara Island and Brooketon on the mainland met with the same success.

When the airfield became serviceable on 15th June First T.A.F. brought in the three Kittyhawk squadrons of No. 81 Wing, No. 457 (Spitfire) Squadron, No. 83 (Army Cooperation) Wing, and No. 86 Wing, armed with Beaufighters and Mosquitos.

No. 81 Wing, whose senior medical officer was Flight Lieutenant M. V. Clarke, set up its camp on a ridge, a position which was not entirely satisfactory; control of *Aedes albopictus* was difficult, and minor outbreaks of dengue occurred. After the war ended this wing was ordered to Japan with the Allied occupation forces. Very few of the medical and pharmaceutical personnel, and no officers at all, volunteered for service in Japan, but volunteers were obtained from other wings. In August 1945 the main activity was the general re-equipment of all units.

No. 86 (Attack) Wing was situated to the north of Labuan strip in a healthy location. In August 1945 its aircraft were mainly employed in a "show of strength" over the North Borneo area and in patrols. The M.C.S. of the wing was No. 29 under Squadron Leader R. C. Gill.

No. 83 (Army Cooperation) Wing (S.M.O., Flight Lieutenant W. M. Barrett) was situated on a series of spurs running in an easterly direction towards the coastal jungle strip; these spurs were surrounded by thick growth and streams and pools, which made mosquito control difficult, and a few cases of dengue occurred, conveyed by *Aedes albopictus*. Owing to the small size of the army cooperation wing there was no provision for an M.C.S., and hospitalisation was provided by the nearest army or R.A.A.F. medical unit. When the fighting ended this wing had little to do, with the exception of No. 9 Local Air Supply Unit which carried out aerial spraying with D.D.T. from Beaufort transports. The Boomerang aircraft of No. 4 Squadron had proved unsatisfactory for this work, as the short fuselage made them difficult to control on the ground.

The camps of No. 62 A.C.W. were excellently set up, and although short of orderlies had in general very good medical conditions. The M.C.S. of this wing, No. 22, after some early intensive work made necessary by a dysentery outbreak, was closed down for reconstruction and improvement of layout. During this period all cases were sent to No. 5 M.R.S. which had been transferred to Labuan from Morotai. The S.M.O., Wing Commander A. W. Raymond, was posted to the headquarters of First T.A.F., and command of No. 22 M.C.S. passed to Flight Lieutenant D. D. Letham, who became the S.M.O.

Hygiene conditions at Labuan were generally satisfactory; deep-pit latrines were the most successful, but because of the unfavourable nature of the ground in some areas and the high level of the ground water, incinerator latrines were permitted for certain units. Washing places were all provided with concrete floors and open roofs, which allowed thorough drying of the floors. Incinerators were the "choofer" type. Fly-proofing

of kitchens was impossible in a number of cases because suitable materials were not available, but fly sprays were in constant use. Grease traps were installed in all kitchens. The serpentine type was found to be the most efficient in this area, with the baffles placed close to the inlet and outlet and leaving a large space in the middle of the chamber for the collection of grease. A central rubbish dump was established and was used by all R.A.A.F. and army units. Only non-offensive material was deposited, the dump area being policed by both Services. Water-supplies were sufficient, many units having their own bores or wells. Water drawn from wells was chlorinated before being used.

During the Labuan operations the R.A.A.F. lost a number of aircraft and aircrew. On 11th June two Beaufighters of No. 31 Squadron collided on take-off and crashed into the sea; three members of the crews were killed and one seriously injured. On the same day one of the aircraft of No. 22 Squadron crashed at Sanga Sanga killing the pilot, and a Beaufort of No. 9 Local Air Supply Unit, which was scheduled to spray the Brunei Bay area with D.D.T., had an accident on take-off, the three members of the crew being fatally injured. On 26th June a Kittyhawk of No. 76 Squadron crashed while strafing Keningau airfield and the pilot was killed. On 6th July another pilot of No. 76 Squadron was forced to crash land in the jungle; he, however, escaped unhurt from the aircraft, detached the dinghy and carried it to a small stream which led to the main river and then to the sea, and finally was picked up by an air-sea rescue Catalina. On 13th July another aircraft of No. 76 Squadron failed to return from a bombing mission and on 7th August a Beaufighter of No. 93 Squadron crashed into the jungle; in this case the two members of the crew were not seriously injured and were later rescued.

Balikpapan. On 1st July the 7th Australian Division made landings at Balikpapan on the east coast of Borneo. The landings were preceded by heavy air and sea bombardments, which reduced the town to rubble but also achieved their object of reducing loss of life among the invading force. The 7th Division then advanced along Vasey Highway, taking Sepinggang airfield on 2nd July. By 3rd July the entire Klandasan peninsula, including the town of Balikpapan, was in Australian hands.

The P.M.O., Leleu, supervised R.A.A.F. medical arrangements in the early stages. They were similar to those for Tarakan and Labuan; the same precautions were taken against malaria, typhus and dysentery and the army treated air force casualties until R.A.A.F. medical units were set up.

No. 38 O.B.U. was the first R.A.A.F. unit to land. It had no medical officer but was accompanied by a well-trained medical orderly. It was followed closely by No. 110 Mobile Fighter Control Unit, whose medical officer, Flight Lieutenant C. B. Colvin, set up a sick-quarters and handled all R.A.A.F. casualties from No. 38 O.B.U. and No. 110 M.F.C.U.

The landing of No. 61 Airfield Construction Wing was delayed because of the ruined condition of Vasey Highway, over which equipment had to

be brought to Sepinggang. However, work on the airfield began on 6th July. The wing had learned much from previous landings; camps were set up satisfactorily, and in all the medical standard was good. The Wing M.C.S., No. 26, still commanded by Squadron Leader Hall-Johnston, landed from Tarakan on 5th July, and was operational on the 13th. It handled all R.A.A.F. hospitalisation until No. 27 M.C.S. of No. 79 Wing was set up under Squadron Leader T. W. Vorrath.

The departure of No. 27 M.C.S. from Morotai was considerably delayed. Flight Lieutenant M. Barry, the unit's surgeon, had been sent back to Darwin to pick up the unit's equipment, and he acted as doctor in the Liberty ship in which he travelled. After leaving Darwin Barry found a case of meningitis on board. He gave the man appropriate antibiotics and unloaded him at Finschhafen. The ship then went on to Morotai, but it was quarantined and left in the stream while those on board and the rest of the unit on Morotai watched the task force set forth for Balikpapan. When No. 27 M.C.S. eventually reached Balikpapan it established itself around a nucleus of brick buildings previously used as Japanese barracks. The buildings were first class, the operating theatre excellent, and the M.C.S. became operational on 15th August, taking over all cases from No. 26 M.C.S. Its bed state at the end of August was 45. Shortly after his arrival, Vorrath was appointed local Senior Medical Officer, and Leleu returned to Labuan.

No. 30 M.C.S. of No. 82 Wing under Squadron Leader W. B. Marsh did not arrive until the second week in August, and it never became fully operational.

Hygiene at Balikpapan was satisfactory. In many areas the nature of the ground and the high level of the ground water prevented the construction of deep-pit latrines, and incinerators of the "choofer" type were installed by six units. Final disposal of rubbish was by dumping it in bomb craters which were covered over when full. Kitchens were provided with adequate fly-proofing for the protection of prepared foods. Because of the shortage of cement, all ablution floors could not be concreted, but metal floors were used instead and were kept thoroughly scrubbed to avoid tinea infections.

Water was drawn from a point controlled by the R.A.A.F. It came from a stream, passed through slow sand filters and was chlorinated in the storage tank. The water in shallow wells on unit sites was unfit for drinking, but could be used for bathing and laundry.

Generally speaking, the sickness rate at Balikpapan was not high. Several cases of scrub typhus occurred among troops of the 21st Brigade, but although the infection was traced to No. 79 Wing's area, exhaustive surveys failed to reveal any mites. The various units set up their sick-quarters quickly.

In the battle round Balikpapan the Thirteenth Air Force provided the major part of the air support, but No. 82 Wing operating from Morotai and No. 78 Wing from Tarakan, where the airfield had at last been made serviceable, flew numerous missions during July which directly and in-

directly supported the operations. No. 79 Wing landed during the last two weeks of July, but it did not do much flying as most of its aircraft were either in transit or at Morotai. No. 82 Wing did not begin to arrive until two days before the Japanese surrender, and there was then little opportunity for action; in any case the Sepinggang strip up to the end of August was not in a condition to take the wing's Liberator aircraft. The camps of the wing were well set up on the strip of coast between Sepinggang and Manggar.

During the Borneo operations most of the operational wings had moved out of Morotai, as had No. 5 M.R.S. The units which remained behind and which included No. 25 Medical Clearing Station under Squadron Leader L. L. Edwards, the S.M.O. on the island, were transferred to the control of No. 11 (Operational) Group. No. 25 M.C.S. took over the patients of No. 5 M.R.S., and was later renamed No. 7 M.R.S. Its charge was gradually expanded until it included all the R.A.A.F. in the Morotai area, even men in transit camps and those on ships in the harbour waiting for convoys. Many of the men who landed at Tarakan had been useless because of diarrhoea, and so as subsequent convoys prepared to depart anyone who felt even slightly off colour was examined. This meant a great deal of extra work for the M.R.S., as many malingerers presented themselves for examination. The bed state averaged 40, but at one time it reached 160. The medical orderlies, who were too few to cope with the increased work, were on duty from 14 to 16 hours a day, and although many of them had rashes, they could not be hospitalised as this would have increased the burden on the remainder. Morotai was not far behind the front line but nurses of the M.A.E.T.U. were already on the island, and Edwards requested that nurses should be appointed to the M.R.S. His request was granted, and thereafter the position eased.

Statistics for the month of August 1945, covering malaria, dengue and dysentery in First T.A.F. are shown in the accompanying table.

	LABUAN		BALIKPAPAN		TARAKAN		LUZON AND LEYTE		1 TAF AREA	
	No. of cases	Cases per 1,000	No. of cases	Cases per 1,000	No. of cases	Cases per 1,000	No. of cases	Cases per 1,000	No. of cases	Cases per 1,000
MALARIA										
(P)	6	·8	1	·2	1	·3	—	—	8	·5
(R)	—	—	2	·5	—	—	—	—	2	·1
(C)	1	·1	—	—	—	—	—	—	1	·1
DENGUE	66	8·9	2	·5	11	3·4	—	—	79	5·1
DYSENTERY										
Flex	2	·2	—	—	—	—	—	—	2	·2
Amoeb	—	—	1	·2	1	·3	1	2·6	3	·1
Clin	5	·7	23	5·2	1	·3	—	—	29	1·8

No. 2 Malaria Control Unit was under the direct administration of First T.A.F. Its No. 1 Section went ashore at Labuan, its No. 2 Section at Balikpapan, and its No. 3 Section at Tarakan. In all areas the anopheline mosquito was well under control. Ground control was by 5 per cent D.D.T. in malariol, and residual spraying was done in buildings. Aerial spraying by No. 9 L.A.S.U. proved most successful, Leleu going on some sorties, for which the early morning was usually chosen because of the low wind velocity. Runs, planned beforehand and guided sometimes by smoke candles on the ground, were made at a height of 1,000 feet and a speed of about 140 knots with a distance of 1,000 yards between each. The length of the spray run was reckoned in time. The coverage obtained was excellent, being checked on several occasions by ground samplers and trays of larvae. The effect on adult mosquitoes was gauged by catches after spraying.

The malaria position during the Philippine and Borneo operations was satisfactory, except on Labuan. On investigation four of the six cases there were found to have taken their atebrin only irregularly.

The figures for dengue at Tarakan and Labuan were high. In both areas *Aedes albopictus* was the vector. At Tarakan units were lodged in houses with the attendant risks of unknown collections of water; at Labuan the units chiefly affected—No. 10 Replenishing Centre and No. 2 Airfield Defence Squadron—were both sited unsatisfactorily near scrub. Much time was spent by No. 2 Malaria Control Unit in *Aedes* control. For example, after the dengue outbreak at No. 10 Replenishing Centre a minute search was made of the whole area for water containers, and residual spraying was carried out of all tents and buildings and power spray of all bushes, ditches and craters in the vicinity.

A few sporadic cases of dysentery occurred at Labuan, the origin of which was uncertain. The cases shown for Balikpapan occurred mainly in No. 82 Wing among men who had been brought from the Northern Territory in the *Luis Arguello*. A few cases also occurred in No. 2 A.C.S., where some difficulty was experienced in providing hygienic messing facilities.

During August a rather more lenient view was taken of criteria for evacuation, and cases of elective surgery, which could have been done locally, were sent back to the mainland through medical channels. Evacuations were:

Skin	49
Mental	23
Surgical:	
traumatic	12
non-traumatic	3
Medical	24
Burns	4
Schistosomiasis	10
Total	125

CHAPTER 28

AVIATION MEDICINE

BRITISH and American research in aviation medicine began in the 1914-18 War, when attempts were made to formulate tests of medical fitness for flying. Investigation of the causes of flying accidents led to identification of those caused by physical defects of pilots, and to a reduction in accidents in this category. Research on the physiological effects of oxygen-lack pointed to the necessity of making use of oxygen mandatory above a certain altitude. Between the wars research was directed to the visual problems of flying, including dark adaptation, to high-tone deafness in pilots, and to the cause and prevention of "blackout" under radial acceleration. After 1936 the R.A.F. expanded rapidly, and to avoid wastage more efficient methods of predicting aircrew efficiency were sought. Research on aviation medicine was coordinated in 1939 when a committee of the Air Ministry, known as the Flying Personnel Research Committee, composed largely of civilian scientists, was set up.

Study by Australians of the medical implications of flying dates from the first world war. In 1918 Major C. H. Kellaway, A.A.M.C., was seconded to the Medical Research Committee in England, and he carried out research on the influence of anoxaemia on the functioning of the adrenal glands. In the 'thirties E. A. Daley and W. D. Counsell of the R.A.A.F., who were both qualified pilots, became interested in the problem of aircrew selection. They sought a correlation between ability to learn to fly and reaction times, mental concentration and neuromuscular coordination, using an apparatus known as the Reid reaction machine. This consisted of a mock-up cockpit with pivoted foot-bar and stick corresponding to the rudder-bar and control column of an aircraft. While the Reid machine could not fully simulate the conditions of flight, in each situation the subject was required to carry out the sets of movements similar to those required in flight, calling into play some of the same physiological factors, visuomotor paths and muscle groups. From comparative trial it was found that the Reid results gave some forecast of flying ability.

Australia also kept in touch with development in aviation medicine in Britain. In 1936, as mentioned, the strong link between the British and Australian Air Forces was furthered by an exchange of medical officers, Squadron Leader Strachan, R.A.F., being sent to Australia and Wing Commander Daley, R.A.A.F., to England, for a period of two years. When war broke out in 1939, R.A.A.F. medical representation in England was considered of vital importance and Flight Lieutenant Grayton Brown, R.A.A.F., who was in Britain doing post-graduate work, was called up for duty and instructed to establish liaison with the Air Ministry.

The D.G.M.S., R.A.F., Air Marshal Sir Harold Whittingham, arranged for Grayton Brown and his successors, the first of whom was Squadron

Leader E. H. Anderson, to have ready access to the R.A.F. Aviation Medical Research Laboratories at Farnborough, Cambridge and Halton, and to be kept informed on all aspects of R.A.F. aviation medicine; from then onwards reports on developments were forwarded regularly to Australia.

In late 1940 Air Commodore T. E. V. Hurley decided to form a research organisation in Australia similar to the British. The Australian organisation was also called the Flying Personnel Research Committee. Its aims were to study and advise on all aspects of medical research which concerned aircrew. Its scope broadly covered selection methods, flying performance, operational efficiency, comfort, safety, survival, escape and evasion. Sub-committees were created to work on problems of flying training, clothing, orthoptics, vision and lighting, acoustics, motion sickness, decompression and hypoxia, anti-G, tropical service and fatigue. Flying Personnel Research Units were established in association with the physiology departments at the Universities of Melbourne and Sydney to handle the laboratory and field work. Government and other scientific bodies cooperated, including the National Standards Laboratory, the Council for Scientific and Industrial Research, the Commonwealth Acoustic Laboratories, the National Health and Medical Research Council, the Fatigue and Tropical Unit at Brisbane University and engineering, manufacturing and other civil organisations. Squadron Leader D. H. Le Messurier (and later Squadron Leader S. L. Prescott) was in charge of No. 1 F.P.R.U. in Melbourne, and Squadron Leader A. K. McIntyre of No. 2 F.P.R.U. in Sydney.

The members of the Flying Personnel Research Committee were specialists in their own field. They included flying officers and medical, scientific and technical men. The original members were the D.G.M.S., Air Commodore Hurley, who was chairman; Professor Harold R. Dew, Sir David Rivett, Professor R. D. Wright, Dr Kellaway, Dr J. H. L. Cumpston, Professor A. V. Stephens, Dr S. V. Sewell and Group Captain E. C. Wackett. The D.G.M.S. as chairman considered the suggestions and recommendations of the F.P.R.C., and decided upon the practicability or otherwise of carrying them out within the R.A.A.F.

Grayton Brown, who had returned to Australia in 1940, was appointed the first MA4, that is, Staff Officer Aviation Medicine in the Medical Directorate. His section produced literature on aviation medical matters and maintained liaison with the aviation medicine sections of units, F.P.R.U. personnel and other medical officers.

At the end of 1943 Wing Commander E. H. Anderson also returned to Australia. He was posted to the Air Board to take over the secretaryship of the F.P.R.C. and until the end of the war supervised all aviation medicine research and training in Australia.

The selection procedures for aircrew began at the recruiting depots and continued throughout the period of their flying training. They included medical examinations, aptitude tests and appearances before aircrew inter-

view boards and category selection boards. Sometimes all these procedures failed to eliminate men who because of psychological and occasionally physical defects would never reach the stage of operational flying. To avoid the wastage involved in training such men the Flying Personnel Research Committee devoted much effort to the development of improved selection procedures.

A survey made some time after the outbreak of war of the causes of failure of aircrew trainees showed that defects of personality played an important part, and it was decided to submit trainees to Group Rorschach personality tests. The Rorschach was an objective technique, the subject being shown ten standard blots, some black on white and some coloured, and asked what he saw in them. A score was made from the responses, and from the score the tester made various deductions—whether the subject was individual or imitative, aggressive or passive, cautious or impulsive, intellectually efficient or otherwise, and whether he was in any way psychologically abnormal. Research on the predictive efficacy of Rorschach testing showed a positive but low correlation between a Rorschach neurotic assessment and failure in flying training. This research was later included in a multiple correlation study which took into account all the various selection procedures, both physical and psychological. The Rorschach tests made what was possibly the largest contribution to psychological testing up to that time, but it was felt that, while this kind of personality assessment was of value, further and more tightly controlled experimentation was necessary.

At the Initial Training Schools for aircrew aviation medicine sections had been formed under the senior medical officers, and these put the trainees through a number of physical tests.

Neuromuscular coordination was tested on a reaction machine designed by Professor Wright, which was similar to the Reid reaction apparatus. The trainee controlled a spot of light which he could move vertically by a control column, and horizontally by a foot-operated rudder-bar. He was required to follow with his light a target light which moved along the four sides of a square, and to pick it up at each of the four corners, if possible completing each side of the square as a single straight line; he was also required to pick up the target light when it stopped at certain points along its path.

Of 198 trainees tested at the Somers Initial Training School it was found that the machine had indicated more than half those who subsequently failed as a result of poor manipulation of actual aircraft controls. There was also shown to be a correlation between the Wright machine score and the flying assessment made at the Elementary Flying Training Schools.

Professor Wright emphasised that of all the qualities needed to make a successful pilot the machine tested only one—neuromuscular coordination—and that natural clumsiness might well be counterbalanced by other qualities. Therefore a trainee who scored poorly on the machine should

not be automatically ruled out; if he had qualities which would make him useful in another role, as an observer for instance, it would be wise to consider transferring him to that category.[1]

The visual standards for aircrew candidates were considered by some ophthalmologists to be too high and by others too low. In a series of 5,000 candidates examined at No. 1 Recruiting Centre, Melbourne, 4 per cent of medical rejections resulted from sub-standard visual acuity, while large numbers had visual acuity less than 6/6. Whether the standards were too high or not, it is significant that a high percentage of decorated pilots were shown in a post-war survey to have possessed high visual acuity.

In an investigation conducted for the F.P.R.C. Squadron Leader Hugh Ryan studied a group of trainees passing through the five Initial Training Schools. He established that ability to learn to fly decreased with a decrease in visual acuity in the case of those who possessed the same visual acuity in both eyes. It was known from a study of the relationship between age and flying results that ability to learn to fly decreased with age, and Ryan made a further investigation to determine whether the correlation between flying training results and visual acuity was in fact associated with a correlation between visual acuity and age. He found that there was a decrease in visual acuity associated with ageing, but that the effect of this on flying results was small. Thus the correlation between flying results and visual acuity, although slightly less marked when age was taken into account, was still considered to be statistically significant.

Further analyses were carried out of groups of trainees having differences of one, two, or three grades between the visual acuity of the two eyes. Analysis of the group with one grade of difference showed no trend between flying results and visual acuity. In the groups with a difference of two and three grades there was a marked correlation between flying results and the degree of anisometropia, suggesting that unilateral keenness of vision was a disadvantage in learning to fly if the visual acuity of the eyes differed markedly. However, without further investigations it would have been impossible to say with certainty that the trend observed was not a chance occurrence.

In the R.A.F. visual standards were relaxed in the course of the war because of manpower shortage. This was never done in the R.A.A.F., but orthoptic training was introduced into the Initial Training Schools, largely due to the efforts of Squadron Leader J. Ringland Anderson. The aviation medicine sections tested trainees, and those found to have some muscle imbalance which, it was believed, would have prejudiced their visual judgments in flying, were given corrective training.

Squadron Leader Anderson carried out an investigation for the F.P.R.C. on the influence of some orthoptic defects on early flying. There was little difference between the success of esophores and exophores, and while only a few men in the group examined had hyperphoria over

[1] This chapter is based mainly on the reports of the Flying Personnel Research Committee. A list of these reports is appended at the end of the chapter.

1.5 degrees, they took longer than average to fly, although none of them failed to do so. Men with controlled convergence and with more than 75 per cent stereopsis appeared to give better results than those without.

Another small group was examined as to the mastery of hand and eye. The figures suggested that crossed dominance was a handicap.

Anderson pointed out early in the war that valuable information as to hyperactivity of the nervous system, the cause of many failures at the Elementary Flying Training Schools, could be found during orthoptic training and from the Livingston depth perception test. He suggested that a test to discover this defect should be evolved, and applied before consideration of the candidate by the selection board. The hypertense would not then be sent for pilot training, but if otherwise suitable, could be classed as fit for observer or air gunner training.

Flight Lieutenant N. G. Traylen studied a group of aircrew trainees who had been classified as fit for pilot training but who had minor orthoptic defects, having failed in one of the tests—for esophoria or exophoria, resting simultaneous macular perception angle, stereoscopic vision (Keystone cards), convergence, depth perception (Livingston test) or suppression. He followed their careers through the Initial Training School, where they were given varying degrees of orthoptic training, to the end of their course at the E.F.T.S. His conclusions were that trainees with minor orthoptic defects which were corrected by training had less chance of passing the E.F.T.S. course than those who had passed all the tests in the first instance, and that there was a relationship between the number of treatments necessary to correct orthoptic defects and ability to learn to fly. However, a further inquiry showed that trainees with more serious defects who had originally been classified as unfit for pilot training, but who were recategorised, responded to flying training as well as did the trainees who were originally up to standard.

In addition to aircrew trainees, orthoptic training was given to some operational pilots who had decompensated visually and to those with ocular imbalance caused by injuries. Some of those who received training felt that they had benefited greatly. Ophthalmologists themselves were divided on the question of the value of orthoptics in flying. Much data was accumulated on the subject, but the demobilisation of personnel in 1945 and 1946 precluded the completion of the statistical work which might have given a clear-cut answer.

Other visual problems considered by the F.P.R.C. were those of colour perception and night vision. The screening test for colour vision employed the Ishihara pseudo-isochromatic plate series, and further testing, if indicated, was carried out with the Giles Archer colour perception unit. In the Ishihara test the subject was shown a series of cards on each of which an abstract figure or numeral composed of coloured dots was presented on a field of dots of another colour. The normal individual and the colour defective made different readings from the cards. The Giles Archer unit consisted of a lamp house, a slide with 3 apertures of 1, 3 and 5-mm

width respectively, and a set of gelatine primary-colour filters enclosed in plain glass, set in a rotatable disc. The candidate was required to distinguish the primary colours presented, his responses being scored against arbitrary standards. A colour defective could be classified as "safe" or "unsafe" for aviation purposes on the basis of his lantern score.

Night vision capacity was tested by a rotating hexagon, in the development of which Group Captain Counsell, Squadron Leaders Ryan, E. D. E. O'Brien and J. L. R. Carter and Sergeant Westmoreland did fundamental work. The apparatus consisted of a hexagonal box with a test panel on each of its six sides; each panel consisted of opal glass, had three horizontal apertures and was illuminated from within by a variable-intensity source. Very low illumination intensities could be produced. Objects to be identified were shown in the three apertures. In the first two apertures were silhouettes of six letters, one letter in each row being reversed either horizontally or vertically: in the third aperture were two forms representing such common objects as aircraft, ships, stars and arrows. The hexagons were installed in the dark room in the orthoptic block at each I.T.S.

Before being tested candidates were dark-adapted by wearing special goggles for half an hour or by spending that period in the dark room itself. During the test shutters covering each panel were opened in turn, one minute being allowed for viewing each panel, the illumination being progressively increased from panel to panel. Finally, the room light was turned on for one minute, and candidates were told that they should look at a piece of cork or other object suspended about 18 inches below the light, this glaring process being an endeavour to simulate conditions in an aircraft caught in a searchlight beam. Candidates recorded what they saw after the exposure of each panel. If an airman obtained a poor mark in two consecutive tests it was considered that he was not physically suited for night flying duties such as night-fighter or intruder pilot, air gunner or bomb aimer. Ryan helped the army by testing the night vision of commandos at Fraser Island.

It had been established by Mellanby and others that decreased night vision was one of the earliest symptoms of vitamin *A* deficiency. If this vitamin were virtually absent from the diet, which might well happen in the case of airmen serving in forward areas where fresh food was unobtainable, night vision loss could develop in as little as three to four weeks.

In 1942 an examination made of airmen serving on Malta showed that the night vision of most had deteriorated, but that there was a dramatic improvement in the condition of those who were given leave in Egypt where they were able to obtain fresh fruit and vegetables. In 1942 Squadron Leader Ryan, using a hexagon, conducted a review of 333 aircrew of No. 9 (Operational) Group and North-Eastern Area units to determine whether their night vision had been affected by the conditions of tropical service. In this instance conditions included not only a restricted diet and a hot, humid and debilitating climate but also routine anti-malarial prophylaxis. The diet of all those examined appeared to be satisfactory and

to contain adequate quantities of vitamins *A* and *C*. Quinine, or more rarely atebrin, was being taken by the men of No. 9 Group but not by those of North-Eastern Area, but no significant difference in night vision capacity could be detected between men of the two formations. The review indicated that defective night vision was uncommon among aircrew in tropical operational zones, only five of the 333 examined being considered unfit for night operations. However, the results could not be regarded as conclusive, as the numbers tested were relatively small and some possibly relevant factors, such as operational fatigue, living conditions and the age of the subjects, were not taken into account.

In fact, although the hexagon was used during four years of the war, it still could not be said to have passed beyond the experimental stage. Subjects could not always be persuaded to use their paramacular vision when doing the test, and individual psychological make-up tended to bias results; some of the objects displayed on the panels were unsuitable, and to the end there was doubt as to the cut-off score below which a pilot should be rejected for night fighting. The R.A.F. also used a rotating hexagon apparatus, but as there were technical differences between the two machines, the R.A.F. pass score could not be adopted by the R.A.A.F.

Aircrew, in particular pilots and blister-watch personnel, made repeated requests for anti-glare glasses. Glare was very trying during all-day maritime patrols and when flying for some hours in low-sun conditions, specially above cloud layers or sea, on the way out and back from night operations. Anti-glare glasses were restful, but while useful in detecting submerged vessels, they hindered the spotting of surface vessels, in some instances by the very action of subjectively reducing tell-tale reflections. Flight Lieutenant S. M. Morson suggested that the optimum all-purpose glass would be green-tinted (transmission 70 per cent) with infra-red absorbing qualities.

Illumination problems were studied by a sub-committee of the F.P.R.C. Experiments made by the Council of Scientific and Industrial Research had shown that red floodlighting in the cockpit of an aircraft was less visually fatiguing to the pilot than white lighting or luminous dial marking of individual instruments, and the former system had been installed in most aircraft, an exception being the Catalina. Morson, who had investigated lighting conditions in Catalinas, recommended that it be installed also in those aircraft. It was true that the red floodlights reintroduced detail, and in this respect detracted from measures directed to simplification and better legibility of dial markings, but nights were seldom dark enough to make dial distraction a problem. Morson proposed that the only exceptions to red lighting in the Catalina should be the pin-point of white light required to illuminate the compass of the Mark IX bombsight for superimposing red on red, and the emergency cocks and levers in the engineer's compartment which should be painted white. Hooding of the two quad-

rant projection lamps was essential to restrict illumination to the region of the instrument panel and thus avoid the danger of detection from below and in front of the aircraft.

As to lighting elsewhere than in the cockpit, Morson found that crews showed a lack of appreciation of dark-adaptation principles. Men would be awakened for the blister watch in the white light of the bunk or engineering compartment; captains would leave the cockpit to consult maps and charts in the white light of the navigation compartment, and navigators, after poring over charts for several hours in a white light, would move out to the cockpit or bow compartment to identify islands or coastlines. In target identification, white torch light would be used to pick out fragments of coastline on the target map, although some captains did insist on hooded torches. Crews usually assembled in white light in the navigation, engineering or bunk compartments to don Mae Wests and parachute harness three-quarters of an hour before estimated time of arrival on target: if there was undue delay in moving to their action stations, insufficient time remained for them to become fully dark-adapted before the target was reached.

Reports of undue visual fatigue in radar operators led to investigations being carried out in the field by Squadron Leader Ryan, and at the National Standards Laboratory by Flying Officer C. J. Mathieson. They investigated errors made when using foveal vision, and measured reaction time using peripheral vision. For faint traces the evidence indicated that continuous scanning, using foveal vision, was essential. Very low levels of illumination were often used in radar stations, and Mathieson recommended that lighting conditions should be improved. Undue visual fatigue was also noticed in some cipher officers. As a result of various reports higher visual standards were later required of men engaged in these types of work.

One of the major human factor problems of flight in World War II aircraft was the physiological stress resulting from the decrease in atmospheric pressure—in particular the decrease in oxygen partial pressure—with increase in altitude. Aircraft required to proceed to high altitudes carried a supply of supplemental breathing oxygen in metal cylinders or "bottles" and this was supplied to aircrew by masks, usually of B.L.B. type. As oxygen bottles had to be light in weight, there was always some apprehension of their exploding under conditions of reduced ambient pressure and temperature. Standard R.A.F. and R.A.A.F. bottles contained 750 litres at 1,800-lbs pressure per square inch. The maximum pressure in American-type bottles was 450-lbs per square inch, which while involving less risk of explosion and obviating certain technical problems, required more space in the aircraft for equivalent oxygen storage. Binding the bottles with high-tensile steel wire reduced the danger in the event of an explosion occurring.

In addition to providing oxygen equipment, it was necessary to provide aircrew with instruction in its use, and to acquaint them with the various

phenomena of high-altitude flight. Training courses were given not only to R.A.A.F. personnel but to U.S. and N.E.I. aircrew. The courses included lectures and films on the physics of the atmosphere, the physiology of respiration and circulation and the effects of oxygen-lack. Decompression sickness, factors influencing altitude tolerance—carbon monoxide, alcohol, smoking, illness, drugs, fatigue—parachute descent technique, the effects of G, cold and frostbite, and night vision were also dealt with. For the purpose of demonstration six cylindrical decompression chambers, each capable of accommodating ten trainees and an instructor, were locally designed and built. They were designed by Mr W. E. Bassett, a Melbourne consulting engineer. The first was installed at No. 1 F.R.P.U., Melbourne. Squadron Leader Morson supervised the courses.

In the chambers varying rates of climb and descent to and from various altitudes were simulated. Demonstrations were given of: (*a*) the correct use of oxygen equipment, (*b*) the effects of oxygen-lack on mental and physical performance, and (*c*) techniques of clearing the ears during descent.

Demonstration routines were arranged so that each trainee would witness the earlier signs of oxygen-lack in others, and experience its milder symptoms himself. The commoner signs demonstrated were cyanosis of finger-nail beds, lips and ears, mental dullness and neuromuscular incoordination with slowing and slurring of speech. With further oxygen deprivation the signs would progress to muscular twitchings, epileptiform convulsions, collapse, reflex vomiting and unconsciousness. These effects were of course not demonstrated in the chambers.

The earliest cerebral signs and symptoms could usually be detected after a relatively long period at 12,000 to 13,000 feet without oxygen. They comprised minor personality changes and decrements in the higher abstract mental functions. Effects at higher altitudes were euphoria, progressive mental confusion and loss of time sense; amnesia sometimes followed these experiences. Restricted peripheral vision, reduced colour perception and visual acuity (retinal effects) were usual concomitants. Despite reduced sensibility, a feeling of cold was often reported.

The mental symptoms of oxygen-lack varied in type and degree as between individuals, and this suggested the possibility of assessing tolerance to hypoxia by psychometric means. A test which assessed tolerance usefully would have to be sufficiently sensitive to register the early hypoxic effects on mental function mentioned above, and would have to be capable of sufficient repetition to eliminate the effects of experimental error and of the differing mental state of a given subject from day to day. It was also necessary that it should exclude or control the operation of learning. Numbers of tests were tried, including the Rorschach test. The latter appeared to reveal slight changes in personality and behaviour pattern due to mild hypoxia, but it proved impossible to discriminate these from others attributable to test repetition. As with other tests tried, no quantitative result could be obtained. The test finally adopted was the Peg Board Psychomotor Test. The peg board consisted of a silver plate pierced

with 100 regularly-spaced holes, through each of which a stylus, insulated except for the tip, had to be placed. The subject was instructed to operate as quickly as possible. Placing the stylus in the first hole started an electric clock, which stopped when the last hole was reached; the stylus also activated a register each time it came in contact with a second silver plate below the first. Thus the total time taken for the test, and the number of holes correctly entered were scored. A second clock recorded the time the tip of the stylus was in contact with the top plate, and this gave a measure of fumbling. Distraction was provided by a buzzer which sounded every time the stylus came in contact with the top plate.

The subject practised on the board until he became moderately proficient. The test was given in the decompression chamber first at ground level and then at a simulated altitude of 18,000 feet, without oxygen. After twenty minutes at altitude the test was repeated. The chamber was then taken to ground level, and the test given again. The change in performance associated with hypoxia was found by comparing the scores made at altitude with the mean of the two ground-level scores. The usual pattern of performance showed initial improvement due to learning with subsequent slight deterioration, often followed by some recovery coincident with adjustment to the new environment, and then at last by a sharp decline, often indicating the necessity for administration of oxygen.

This test was also used to estimate the effects of anti-malarial drugs on susceptibility to high altitudes. Flight Lieutenant Traylen suggested that it could in addition be used as a measure of fatigue.

Decompression sickness, of which the most frequent manifestation was "the bends", was another condition occurring in aircrew at high altitudes. According to the terminology in use during 1939-45, decompression sickness included all conditions due to evolution of nitrogen as bubbles, under reduced ambient pressure, from solution in the blood. "The bends" comprised pains in the limbs, especially in the region of joints, which could be so severe as to be incapacitating—this quite apart from the paralysis, due to the pressure of evolved gas on a peripheral nerve, which sometimes supervened. Partial blindness could also occur, probably due to the generation of nerve pressures in the region of the orbital foramen and perhaps of the pituitary fossa. "The chokes" was a syndrome likewise due to nitrogen evolution and characterised by tightness in the chest, dyspnoea and productive cough; this condition was of greater significance than "the bends", as it usually heralded circulatory collapse if allowed to continue. "The creeps", so called by the Americans, was yet another manifestation due to nitrogen evolution, in this case subcutaneously.

In contrast to diver's "bends", only in rare cases did men with aviator's "bends" fail to recover completely on recompression. It is probable that some cases of neurocirculatory collapse, attributed at the time to nitrogen evolution, were in fact caused by an entirely different mechanism.

Decompression sickness too was studied in the decompression chambers. A run was made to 35,000 feet and that altitude maintained for three hours. It was established that there was no definite relationship

between the site of "bends" and a previous history of local trauma or disease, although in a number of cases "bends" did occur in sites where there had been injuries, such as, for example, severe sprains, fractures, and in one case an acute osteomyelitis. Some of those who suffered severe "bends" were given preoxygenation for an hour and a half with good results, but it was demonstrated that oxygen before flight would not prevent the occurrence of "the bends", although it would delay the onset. The only known method of prevention was maintenance of ambient pressure by means of partial or full-pressure suits or by pressure-cabined aircraft. Some work was done on full-pressure suits by the F.P.R.C., but up to the end of the war a satisfactory suit had not been developed.

Decompression chamber investigation could have indicated those trainees who were unfitted for high-altitude flying by reason of susceptibility to decompression sickness. However, reliable assessments could not be made on the basis of only one test decompression, and during the greater period of the war the availability of flying personnel was such that the necessary follow-ups were only rarely possible.

Clinically, the chambers proved useful in occasionally revealing the presence of dental caries and unsatisfactory dental fillings by production of aerodentalgia; sometimes recent dental examination of these cases had been clear. More light was also thrown on the mechanisms of Eustachian tube blockage and the conditions leading to chronic aero-otitis media.

Another of the major problems of aviation medicine involved the physiological effect of radial acceleration.

In Sydney Professor F. S. Cotton had been considering from first principles the problem of "blackout" in aircrew. The effect of centrifugal force on a pilot when pulling out of a dive or flying in a tight turn was to draw the blood away from his head and into his limbs and lower portions of his body. Reduced blood supply to the head, resulting in oxygen-lack in the light-sensitive elements of the retina, produced a progressive reduction of vision—"greyout", passing on to "blackout". Greater accelerative forces would reduce blood supply to the brain sufficiently to cause unconsciousness. There was shown to be a rather wide range of individual variation in the amount of G pilots could tolerate before "blacking-out".

Working independently and without knowledge of similar research being done abroad, Cotton produced an air-inflated anti-G suit, the action of which was to prevent "pooling" of blood in the vessels of the abdomen and lower extremities of the body; the heart was then capable of pumping blood to the brain against the centrifugal force. The suit consisted of leggings, which were worn from the soles or the ankles up to the top of the thighs, and separate shorts which overlapped the leggings. Four rubber bladders were contained in each legging and two in the shorts. A G-actuated valving mechanism admitted air from a compression cylinder to the suit, its action being so graduated that air pressure admitted to the bladders was related to the centrifugal force applied to the system.



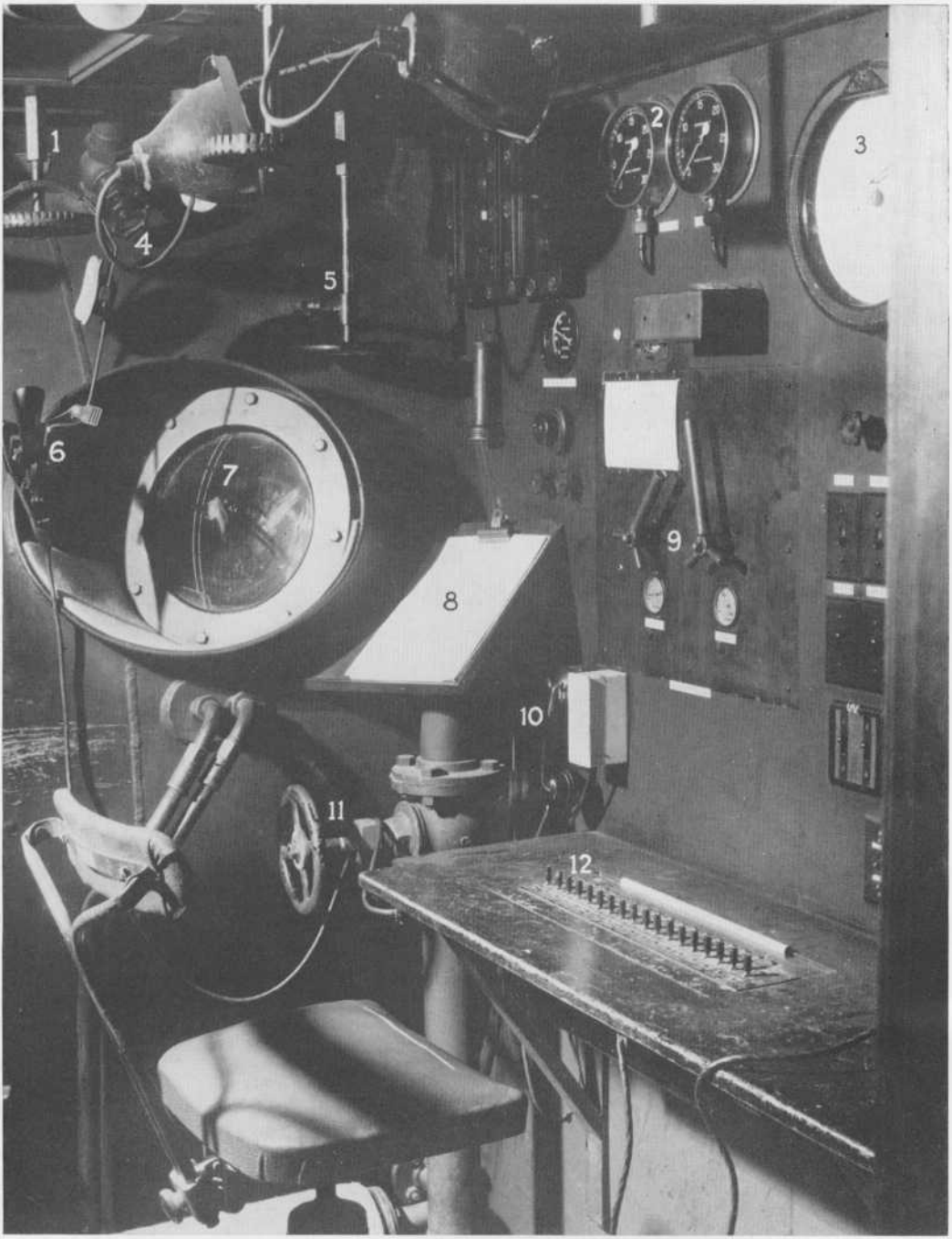
(Drawn by Roy Hodgkinson)

Air-sea rescue after a Mitchell bomber crashed into the sea. The second pilot (wearing Mae West) is being drawn on board by Flight Lieutenant J. G. Shelton (at pilot's feet) and Sergeant G. J. Bell. A medical orderly, Warrant Officer Ring, is reaching for a first-aid bag. Holding the stretcher is Flying Officer A. J. Filear, and in the water a native crew boy, Lega, steadying the dinghy.



(Drawn by Roy Hodgkinson)

A spotting plane directs a rescue boat to the scene of an aircraft crash on the Laloki River, December 1943.



(*R.A.A.F.*)

Operator's station of decompression chamber, indicating: (1) man-lock ascent and descent valve controls; (2) man-lock and main chamber vacuum gauges; (3) chamber barometric pressure recorder; (4) chamber ventilating valve control; (5) main chamber ascent valve control; (6) operator's intercommunication head set; (7) pressure-glass observation window in side wall of cylindrical main chamber; (8) chamber "flight" log pad; (9) man-lock and main chamber 100 per cent oxygen-flooding controls and oxygen supply gauges; (10) battery-operated emergency telephone handset; (11) main chamber descent valve control; (12) chamber intercommunication switchboard.

The external layer of the suit was of a special non-stretch fabric, preventing outward expansion of the inflated bladders so that their pressure was operative inwards against the body.

So that the suit could be tested under controlled conditions, the F.P.R.C. and the National Health and Medical Research Council provided funds for the construction of a centrifuge at No. 2 Flying Personnel Research Unit. Squadron Leader K. V. Robertson and a number of other pilots tested the suit on the ground, allowing themselves to be accelerated many times in the centrifuge, and later in the air. Normally "blackout" followed exposure to 5G or 6G for periods in excess of 2½ or 3 seconds. Wearing this suit, a pilot's G-tolerance was increased by about 30 per cent.

During 1941-42 Cotton visited Canada, the United States and the United Kingdom with Dr Charles Kellaway. He found that in America Commander J. R. Poppen, U.S.N., had been working on the problem of "blackout" under high accelerations, while in Canada Wing Commander R. Franks had invented an anti-G suit which applied pressure to the pilot's limbs by means of water-filled bladders. Cotton's design was made available to the Americans, and of course to the Canadians. The former proceeded to develop it, and in 1944 a simplified version was being worn by American fighter pilots in the South-West Pacific and European theatres.

Improvements to the suit were also made in Australia. The original air valve required more compressed air than could be conveniently carried in an aircraft, and Dr D. M. Meyers of the National Standards Laboratory designed a more economical type. The R.A.A.F. adopted the suit in 1942 and by 1944 three squadrons had been equipped with it.

Another of the effects of acceleration was motion sickness. The symptoms included pallor, sweating, nausea, vomiting, changes of blood pressure, pulse rate and respiration, as well as sensations of weakness, apathy and depression, and loss of motivation. Some degree of spatial disorientation of the sufferer was not uncommon.

Persistent motion sickness in aircrew trainees was a serious cause of wastage in the R.A.A.F., R.A.F., and Allied air forces, the Americans reporting a scrub-rate of 5 per cent from this cause. Personnel who had reached the stage of operational flying were not immune; gunners suffered more than observers because they were frequently at aircrew stations (such as the rear turret) in which the random accelerations resulting from turbulence and those due to manoeuvring were accentuated and probably also because they had been less exposed to aerial conditions during training. Pilots were relatively immune, apparently because the knowledge that they controlled the machine and their preoccupation with doing so helped to maintain their sense of spatial orientation and suppress untoward reactions.

The sensory organ most involved in the production of motion sickness was probably the internal ear. It is possible that the eyes were sometimes involved; often, however, visual reference to the horizon or the ground helped to preserve orientation and offset sickness. It was usually found

that when external visual reference was excluded susceptibility was greater; blind flying in rough weather was particularly upsetting, and flying-boat crews who were down in the fuselage and could not see out suffered more than the crews of other aircraft.

In addition to the primary physical factor of motion, many secondary factors were involved in motion sickness, such as cold, hunger, fatigue, alcoholic hangovers, excessive smoking, and vibration, including noise. A man's capacity to withstand motion would be weakened by general ill-health or debility, or by particular conditions such as disease in the upper respiratory tract, Eustachian tube blockage with inability to ventilate the middle ear, *otitis media,* or sinus infection. Alimentary tract disturbances such as indigestion, gastritis and gastro-enteritis could have a similar effect. The expectation of vomiting in an aircraft or the sight, smell or sound of someone else vomiting could precipitate an attack. Suggestion also worked in the opposite direction. It was usual for instructors to emphasise to trainees that sickness was a perfectly natural initial reaction to flying, and that nearly always the tendency disappeared. Likewise, anything suggestive of sickness was to be avoided, such as the routine issue of paper bags, or taking a trainee up in an aircraft which was redolent of a previous mishap.

Much research was done in Germany and Russia before the war on pre-selection methods which would eliminate men who were chronically susceptible to motion, and in Australia during the war years Squadron Leader A. K. McIntyre carried out important work in this field.

Inquiry into the history of previous susceptibility to motion sickness was included in the examination of candidates for flying. It was important to note the degree of exposure in evaluating the significance of the history, and Howlett and Brett developed a system of grading motion-sickness history. Men were classified A (good), B (fair), C (bad) and AD (no sickness but little exposure). It was also important but extremely difficult to ensure that candidates did not suppress relevant facts from fear of being rejected. It was clear that there was a general relationship between history and actual occurrence of motion sickness, but even selection based on a carefully-taken history could achieve only a small reduction in the incidence of sickness, and this at the expense of rejecting a number of applicants who would either not have been sick or who would have graduated in spite of sickness.

The swing was the most important of the pre-selection methods. It enabled motion sickness to be studied in the laboratory where the disturbing stimuli responsible could be controlled. The swing at first used in Australia consisted of a wooden space-frame, from which was suspended a stretcher-like structure on which the subject lay: the swing was pushed by hand, and described an arc of about 135 degrees.

It was generally recognised that linear rather than angular accelerations, especially vertical linear accelerations, were most disturbing to motion susceptibles. The early types of swing produced linear and angular acceleration concurrently, and their fluctuations were rhythmic and pre-

dictable, unlike the motion of aircraft in turbulence. In 1942 a vertical linear accelerator was designed by the R.A.A.F. and erected at the University of Sydney. This functioned on the principle of a lift, producing vertical positive and negative accelerations which could be varied in timing and magnitude. This variation was such that the motion appeared random to the subject. In test runs made before the end of the war several susceptible subjects were readily made sick. Most of the Russian swings were reported to be of the 4 point suspension type in which the angular component had been largely removed, but they did not give pure linear accelerations, and their fluctuations were still rhythmic. Other motion machines were the Canadian "Roll-Pitch Rocker", which resembled a swing with a lateral rocking movement, and another Canadian machine which produced rhythmic "G" changes comparable with the radial components of a simple swing; these did not produce sickness readily. A machine which produced pitching, rolling and yawing movements, singly or in combination, was developed at Camp Edwards, Mass., but this was used chiefly in anti-motion-sickness drug studies.

At first, data on swing tests indicated a high degree of correlation between swing and air sickness, and led to hopes that the tests would be valuable in pre-selection. However, in the early tests comparisons were made between the swing susceptibility of non-airsick groups and that of aircrew grounded or referred for chronic airsickness, among whom it would be expected that a high incidence of swing sickness would occur. Later studies, in which groups of men were swung before training and followed up after training, showed much less correlation. There was also a discrepancy between results obtained at different centres. A possible cause of this was the failure at some centres to control adequately certain important variables, in particular the position of the head. During 1941-42 a motor-driven Barany chair was used at No. 2 Clinical Investigation Section, R.A.A.F., for investigating airsickness cases; it was shown that during rotation at a constant rate with the eyes closed, after the initial acceleration had disappeared, no sensation of rotation could be felt, provided the head was kept still. Movement of the head in any plane other than that of rotation produced striking illusions of movement of the whole body. If this head movement was rapid, disorientation occurred; this effect was known as the Coriolis phenomenon. Similar effects were noticed on the Sydney centrifuge, which was of the constant rotation type.

The results of physical tests to evaluate general fitness, visual characteristics, blood pressure, pulse rate and tilt-board reactions, were considered separately and collectively in the hope that they might be of value in predicting motion sickness susceptibility, but without success. The use of cholinergic drugs and the electroencephalogram as predictive measures was more promising, but by the end of the war had not proceeded beyond the experimental stage.

The greater part of motion sickness research carried out during the war concentrated on physical factors and the development of physiological pre-selection tests and methods of treatment. In Australia, however, the

services of an experienced psychiatrist were also obtained, and the psychological make-up of motion-susceptible subjects was investigated. Dr W. H. Fraser made a psychological assessment of approximately 100 aircrew referred to No. 2 F.P.R.U. for motion sickness. Among them was stated to be a high proportion of clinical or sub-clinical neurotic personalities; however, when he examined a further group of aircrew trainees with comparable maladjustments he found that none of them had ever experienced motion sickness in spite of ample exposure.

Pre-selection by actual experience of the disturbing environment, including as it did all relevant physical and psychological factors, was at once the most obvious and effective procedure. Yet in practice it presented such difficulties that little or no use was made of it until late in the war when the grading-flight system was introduced into the R.A.F. and the R.A.A.F. Much of the work previously done by category selection boards was eliminated, trainees now being graded and categorised according to in-flight performance. It is noteworthy that in Germany pre-selection of airborne troops was achieved by giving recruits a prolonged trial flight with numerous landings and take-offs under observation.

Methods of prophylaxis and treatment of motion sickness included drugs, posture, habituation and suggestion. The administration of a placebo alone could cause a diminution of 20 per cent in the incidence. Drugs of the scopolamine group, particularly hyoscine and hyoscyamine, gave the most consistent results. Barbiturates, including a number of newly synthesised types, were disappointing, as were benzedrine and ephredine, while certain combinations of drugs appeared to act synergistically, giving relatively better prophylactic effect than the constituents taken alone. It was claimed that up to 80 per cent of susceptible subjects were given protection by any of three different combinations, namely the Army Development Type (sodium amytal, 16 mgm; hyoscine, 0.22 mgm; and atropine sulphate, 0.16 mgm); the Canadian experimental capsule (benzedrine, 10.0 mgm; hyoscine HCl, 0.4 mgm) and Capsule "B" R.C.N. (Hyoscine HBr, 0.3 mgm; hyoscyamine HBr, 0.18 mgm; and niacin 100.0 mgm). It was claimed that the last of these was effective even if administered after the motion-sickness had developed. An interesting point was the poorer degree of efficacy of drugs observed in motion susceptibles of the psycho-neurotic type as compared with those without such features.

Prophylaxis by means of posture involved placing the potential sufferer's head in a satisfactory position. Lying supine with little or no pillow seemed to be the best posture, and extending the head even when sitting or standing was also helpful. An American experiment confirmed the value of posture in diminishing the incidence of motion sickness: 10,000 men were given a one or two hour flight; of 97 simulated casualties who were carried supine on stretchers not one became sick, whereas of the remaining troops transported in the ordinary sitting position 3.8 per cent became airsick.

A process of habituation to motion commonly occurred, and probably 80 per cent or more of those initially susceptible eventually became

adapted. Men might be conditioned not to be sick by a series of graduated exposures to motion without sickness, just as they might become conditioned to being sick if on a series of occasions sickness was experienced. The importance of gradual introduction of trainees to the more violent flight manoeuvres was an obvious precaution. Habituation to swing motion also occurred, but research showed that adaptation lasted only for about one week, and also that there was little relation between adaptability to swing and adaptability to aircraft motion. It was known that the Russians attempted to habituate men to aircraft motion by graduated exposure to severe forms of vestibular stimulation both active and passive. The former consisted mainly of physical exercises involving much head movement and the latter of exposure to accelerations in training wheels, jumping nets, swings and other sources of labyrinthine stimulus. Research in habituation was also conducted by the Canadians.

Noise in aircraft posed two inter-related problems: that of securing efficient intercommunication against a high "background" noise level, and that of deafness in personnel exposed to noise. Both problems were studied for the R.A.A.F. by the Acoustic Research Laboratory which had been established in the Kanematsu Institute at Sydney Hospital under Dr J. C. Eccles. In 1943 Mr N. E. Murray became director of the laboratory, which was later transferred to the New Medical School, Sydney University.

In most types of aircraft, equipment for communication between crew members, between aircraft and aircraft and between aircraft and ground was on the telephone principle. This necessitated earphones which would exclude as much background noise as possible. Many of the helmets and headsets used in the early years of the war provided little exclusion of background noise, while those which did give adequate exclusion pressed directly on the ear and were too uncomfortable for continuous wear for long periods. Catalinas, to take the most extreme case, flew for 30 hours non-stop, and their crews rather than endure the discomfort, discarded their headsets when possible, and accepted the temporary deafness which resulted. However, if these men were repeatedly re-exposed to acoustic trauma before full aural recovery, hearing loss could become cumulative and ultimately non-recoverable.

Murray designed earpads which combined comfort with adequate exclusion of background noise. The volume enclosed within the earpad was enlarged, and the pinna was freed from pressure, which was taken on the head surface by a latex rubber doughnut. These doughnuts were of two types. The first consisted of a single-layered sealed sac filled with Java kapok. After long use and repeated changes of ambient pressure at altitude the kapok tended to pack down and become hard, but the design provided good protection from lower frequencies and satisfactory long service at low altitudes. The second type was of twin-layered construction, the layers being separated by air only, and with an air leak to equalise pressure. This last feature was considered impracticable in the first type, as the taking up of moisture from admitted air by the kapok may have

resulted, under tropical conditions, in the growth of fungi within the doughnut.

A headband was designed to be used in conjunction with the earpads. It provided sufficient pressure to give the required acoustic seal, gave a wide range of adjustments and was comfortable even when worn for long periods.

In several types of Service helmet the earphones were prone to dislodgment, so that they were not directly over the ear canal. Murray designed a summer helmet to be used with the Acoustic Research Laboratory doughnut, with straps and tapes providing lateral and vertical adjustments. Winter helmets, which already had lateral adjustments, were modified to give vertical adjustment of earphone position.

For aircrew trainees, army gun and tank crews, and for engine-testing crews who did not wear head-sets or helmets, eardrum protectors in the form of earplugs were required. The plugs already available were of natural rubber or ebonite. The rubber type deteriorated on contact with ear wax and oils, swelling to approximately 150 per cent of its normal size after a few days' wear; the ebonite type was also unsatisfactory in that it was uncomfortable and failed to give reliable noise attenuation. The Acoustic Research Laboratory designed a plug which was entirely satisfactory. The problem of materials was solved by the Americans, who had experimented successfully with a synthetic compound, Neoprene. To guard against ear infections which would be caused by wearing ear plugs in the hot, moist conditions of the tropics the outer surfaces of the plug were smeared with an antiseptic consisting of merthiolate contained in a lanoline base in a concentration of 1 in 100,000, which was suggested by Professor H. K. Ward and Dr H. L. Jensen of the Bacteriology Department, Sydney University. This also lubricated the plug for ease of insertion, and improved the acoustic seal. The Neoprene plug could be washed in soap and warm water or in alcohol. The plugs were made in three standard sizes, and were issued in a small metal box containing two plugs, an inserter and a tube of antiseptic. The earplugs could be worn in addition to earphones, where the existing headsets or helmets failed to give sufficient protection from ambient noise levels, or on long reconnaissance flights when it might be necessary to remove the headphones or helmet for reasons of comfort or in order to sleep. If the ambient noise level was high and the headset or helmet gave only a small noise attenuation, the use of the earplugs by raising the signal-to-noise ratio would improve the ability to hear through the headphones; this was especially so where the volume of the signal could be controlled.

The original imperforate earplug was worn by test subjects in low-pressure chambers during rapid descents from simulated altitudes of 10,000 to 35,000 feet. It was found that *otitis externa* occurred in descents from high altitudes, reaching the maximum incidence on the 35,000 feet test. This was avoided by boring a fine air channel down the centre of the plug, which allowed pressure equalisation without compromising acoustic effectiveness.

Research on laryngophones resulted in the design of a model which gave satisfactory articulation in noise through the standard R.A.A.F. transmitter-receiver. Objective testing apparatus, which was developed by the Acoustic Research Laboratory, ensured that each model would be of a uniformly high quality. It was found that when oxygen masks were worn a small carbon oral microphone gave superior articulation in noise to a laryngophone, and the laboratory modified the standard carbon microphone so that it could be used with oxygen masks.

Aircrew and wireless telegraphy trainees unused to listening against high background noise levels often found difficulty in hearing signals in aircraft. In order to provide ground training for this in-flight situation, the laboratory developed an electronic noise generator from which simulated aircraft noise was introduced directly into the earphones at a predetermined decibel level. Usually considerable improvement was evident after a short period of training.

In primary training aircraft such as the Tiger Moth and the Wackett Trainer, and in the Wirraway when first introduced as a trainer in the S.F.T.S's, verbal communication between instructor and pupil was by means of Gosport speaking tubes and simple earphones. Speech intelligibility over this system was low. Using a Harvard phonetically-balanced word list and a standardised background noise level of 118 decibels, it was found that only 15 per cent of the words could be understood, whereas under the same conditions 63 per cent of the words could be understood over the standard R.A.A.F. electrical intercommunciation. Because of the semi-fixed mounting of the mouthpiece communication was particularly difficult at the important point of take-off when both the pupil and instructor might be looking over the side of the aircraft. Instructors also complained of voice fatigue. Murray, working with Flight Lieutenant A. H. Pollard, designed a speaking tube system which raised the intelligibility so that 95 per cent of the words could be distinguished. The system featured folded exponential horns for the mouthpiece and earpieces, and the mechanical and mounting arrangements of the former were designed to allow easy approximation of the mouth without use of the hands. The system could be extended for use by more than two parties. In electrically equipped aircraft it could be carried as a reserve to be used in the event of failure of the electrical intercom.

While the speaking tube overcame to a great extent the difficulty experienced by pupils at E.F.T.S's in hearing their instructors, there remained the problem of articulation of the instructors. The laboratory gave advice on the construction at the Central Flying School, Parkes, of a noise room in which synthetic noise could be generated and where instructors could be given training in the different factors involved in speaking intelligibly in noise. Meanwhile, training patter had been reviewed to eliminate words which were inherently difficult to distinguish in noise.

The laboratory also developed articulation tests, so that communication equipment could be evaluated in the laboratory against a background of

noise similar to that against which it would be used in the Services. For R.A.A.F. purposes the noise level and spectrum simulated those of a Beaufort bomber under fast cruising conditions. The articulation test consisted of a series of words made up from a matrix of phonetically balanced lists of 100 words, which were read out to a team of listeners by three trained announcers with different types of voices.

In March 1943 a committee was set up to advise the Commander-in-Chief in the South-West Pacific, General MacArthur, on the medical problems of tropical service. It was known as the Combined Advisory Committee on Tropical Medicine, Hygiene and Sanitation, and its members, who were experts on tropical diseases, were drawn from the medical services of Australia and the United States. Group Captain A. H. Baldwin, Director of Hygiene and Tropical Medicine, was the R.A.A.F. representative.

A few months later an army research unit was established at Cairns under Brigadier N. H. Fairley to study methods for the prevention and treatment of malaria. Some research applicable only to the air force was done there on the possible effects of anti-malarial drugs on aircrew performance. Drugs then in use included quinine, atebrin and other experimental types. The British were at first averse to the use of atebrin by aircrew, although it was admittedly a better drug than quinine for malaria prevention. Thus it frequently happened, with undesirable effects on morale, that neighbouring units in the S.W.P.A., performing the same type of duty, were issued with different drugs for anti-malarial prophylaxis, each being told that their drug was better and safer than others for flying personnel. The tests carried out at Cairns indicated that in their effects on dark adaptation, susceptibility to motion and high altitude and G-tolerance all the suppressive drugs were equally innocuous.

It was known that hypoxia and chill could precipitate relapse in men with latent malaria, and an investigation was carried out at Cairns to see if these factors might also precipitate attacks of malaria in aircrew and airborne personnel who were taking anti-malarial drugs. Eighteen volunteers were selected at the L.H.Q. Medical Research Unit at Cairns: they were subjected to repeated bites by *P. falciparum* and *P. vivax,* and were given suppressive doses of either atebrin or atebrin and sulphamerazine, quinine taken in suppressive doses having been found ineffective in controlling experimental infections with the Papuan strains of these mosquitoes. The volunteers were flown from Cairns to Melbourne, and after altitude tests given over a period of weeks in the decompression chamber at Melbourne University, were flown back to Cairns, all this taking place during June when the weather in Melbourne was distinctly cold. Differential blood counts, drug level estimations and urine tests were carried out. These showed no signs of malaria in any of the volunteers, indicating that hypoxia and cold were unlikely to cause a breakdown of malarial suppressive control.

Professor D. H. K. Lee of the Tropical and Fatigue Laboratory of the University of Queensland, in conjunction with the R.A.A.F., through the F.P.R.C., and the National Health and Medical Research Council, carried out extensive investigations into the physical and psychological effects of tropical service on air force personnel.

Many servicemen in the tropics—officers, including medical officers, and other ranks—shared a conviction that they had deteriorated since leaving the mainland; they felt that they were suffering from "tropical fatigue". They complained of an increase in incidence of ill-health, of loss of appetite, weight and energy, of impaired memory, a slowing of the mental processes and a heightened irritability. The question was whether the complaints of deterioration were valid, and if so, whether the deterioration was physical, mental or a combination of both.

An investigation showed that there was, in fact, more ill-health during a tropical tour than during a corresponding period of duty in the southern States. In a large group of men examined in tropical areas it was found that in addition to an average incidence of malaria and dysentery, disorders of the skin and the alimentary canal were rampant; minor accidents, including burns, were frequent, and there was a high incidence of mild functional disorders. The latter were very common both in times of stress and towards the end of a tour of tropical duty. In one unit there was a particularly high incidence when its members were being subjected to night bombing; with the removal of combat stress the incidence fell sharply.

An attempt was made to assess the physical condition of R.A.A.F. personnel in the tropics by tests of stance, gait, dress, nude weight, height/weight ratio, sensations upon tilting and general physical fitness, and to relate the assessments to length of tropical service. Stance, gait and dress were appraised by the officer in charge of the field team making the investigation; nude weight and height/weight ratio were measured in the usual way with platform scales and measuring slide. In none of these tests was any significant correlation found with length of tropical service. The finding with respect to weight was substantiated by a separate investigation of army personnel made by Captain R. K. Macpherson and Squadron Leader P. B. McGovern. A group of 730 soldiers of various ranks and duties was weighed in the field, and 16 weeks later 236 of the group were re-weighed, the operational situation preventing the re-weighing of actual fighting men. A record was kept of the age, length of tropical service and duties of each man, and of any hospitalisation between the weighings. The results revealed that there had been no significant decrease in weight. However, a group of men doing heavy skilled labour showed a significant negative relation between loss of weight and length of tropical service: the longer their period of service in the tropics before the test, the less was their weight loss over the 16 weeks' period. This bore out a claim previously made by the laboratory that acclimatisation to work in the tropics was a long-term process: after 28 weeks' tropical service the men in the heavy skilled labour category were approaching not departing from an equilibrium.

Tilting reactions were obtained by recording the changes in the arterial pressures and pulse rates of men who after a period of recumbency on a stretcher were quickly tilted to an angle of 75 degrees, their apprehension of falling being allayed by footrests and retaining chest straps. Macpherson followed up this question of the relationship between dizziness following postural changes and residence in the tropics by a tilt-board examination of 1,257 R.A.A.F. and R.N.Z.A.F. ground staff in the tropics and 251 in a temperate climate, these constituting the tropical and control groups respectively. After a statistical analysis of the results the conclusion was reached that postural cardio-vascular insufficiency was more marked in the humid tropics than in temperate regions, but only to a very slight degree.

Medical officers serving in the tropics differed in opinion as to the effect of exposure to tropical conditions on the systolic and diastolic blood pressures, and Macpherson made an investigation to determine whether these tended to rise or fall under tropical conditions. Taking the data provided by a survey of the resting pulse rates, systolic and diastolic blood pressures and pulse pressures of 1,000 R.A.A.F. personnel serving in the tropics and of a control group of 250 ground crew serving near Brisbane, he compared the results with those obtained from 2,000 young aviators examined at Long Island, New York, in 1921 and 1922. In the tropical group no correlation could be found between the observed values and the length of tropical service, but both the R.A.A.F. groups showed high values for the resting pulse rate compared with the American group, and there was a small difference between the systolic values of the R.A.A.F. tropical and control groups, the former being the lower. This latter factor might be of importance for individuals whose values lay at the extreme of the range; a slight fall might adversely affect an existing hypotension or reduce the effect of an existing hypertension. It also provided some support for the opinion that there was an element of danger in the rapid transport of a hypertensive from a tropical to a cold climate.

Physical fitness was gauged by the Harvard Pack Test in which the subject, carrying a pack load equal to one-third of his body weight, stepped up and down from a stool 16 inches high once every two seconds until he could not maintain the pace or until five minutes had elapsed. Only in this test was any significant correlation found with length of tropical service, fitness tending to deteriorate as the length of service increased, though the rate of deterioration was relatively small.

The Harvard Pack Test was also used during a special laboratory inquiry conducted by the Fatigue Laboratory into physiological effects of heat and humidity. The inquiry had as its subjects four men of widely differing age and physique. Wearing the dress prescribed for Australian troops in the tropics, they were tested in an environmentally-controlled "hot room" five mornings a week for five weeks. Two exercises were given, the Harvard Pack Test and another test which consisted of marching at the equivalent of 3.2 miles an hour on a tread-mill carrying an army pack weighing 18 kilos (39.6 pounds). At the start of each session each man was weighed and put into chloride-free clothes. The temperature

and humidity of the "hot room" were varied over a wide range, and pulse rates and rectal temperatures were taken at predetermined times. After each session chloride excretion was estimated from water in which the men had washed themselves and their clothes.

It was found that sweat production increased greatly with higher temperatures but was little affected by higher humidities. Sweat evaporation also increased with temperature but decreased with humidity. Under conditions of strenuous exercise the values were found to increase exponentially with daily repetition, but became much less variable with habituation. The equivalent rectal temperature values were found to decline as the experiment progressed.

It was concluded that the human organism is more profoundly affected by humidity than by temperature. Rectal temperature was reduced and exercise tolerance raised by repetition, meaning a combination of training and acclimatisation; sweat rates, however, showed no decrease with repetition. These conclusions were in general agreement with those obtained by the Physiological Research Unit of the Royal Navy.

It was considered that the physical findings did not account for the condition termed "tropical fatigue", and it was therefore concluded that the cause of such fatigue must be partially psychological.

Where there was a strong unit *esprit de corps* and good discipline complaints of tropical fatigue were fewer. The possession of an absorbing and congenial job also contributed to adjustment to the tropics, there being fewer complaints among men in the skilled musterings.

The Fatigue Laboratory recommended that the aggressive climate of the tropics should be met aggressively. The traditional midday siesta should be discontinued: midday sleep was not considered very refreshing as, in a recumbent position, the free play of air about the body was hindered, and the would-be sleeper usually lay in a bath of perspiration. The siesta also meant either beginning work early, and so getting up when the temperature was lowest and sleep most refreshing, or ceasing work late and thus cutting short the time which could be devoted to mental and physical recreation. Service personnel should also be disabused of the idea that it is possible to live healthily in the tropics only for brief periods. Recreational and educational facilities should be exploited to the utmost, and the courtesies and usages of society in temperate zones should be observed as far as possible.

The design of clothing and the weight and type of the material most suitable for the tropics were studied in some detail by Professor Lee. He used both subjective and objective methods of assessment. Subjective evidence of comfort, although liable to fallacies, was found on the whole to provide a sensitive index of change in the heat load. It therefore was accepted, though cautiously. Objective evidence was provided by measuring the physical thermal properties of clothing materials and assemblies, piecing together the results, and deriving from them empirical expressions relating to the heat exchange behaviour of the clothed body and its

environment. These findings could be translated into terms of practical clothing.

Lee stressed the important function of sweating in preserving the heat balance of the body. Restrictive clothing which did not allow sweat to evaporate freely interfered with body cooling and could have serious local and metabolic effects. It could result in permanently wet areas and the development of tropical dermatoses. Metabolic effects could range from languid inefficiency, through heat cramps to hyperpyrexia and "heat stroke" in an extreme case. Lee's recommendations, which concerned only the thermal properties of clothes, are summarised:

Underclothing was desirable in hot, dry climates but undesirable in hot, humid conditions. It should be light in weight and absorbent, and should be washed frequently.

A one-piece main garment was loose and comfortable, and allowed free body movement, but it also had disadvantages: it was difficult to don and remove, the upper part could not be discarded separately, and local damage necessitated renewal of the whole garment.

In a two-piece garment the top should be designed so that it could hang outside the lower garment or be tucked in, as required: sleeves should be long for hot, dry conditions, but short or rollable for humid, and the neck should be able to be worn open or buttoned up. The safari jacket was a suitable design, and as plenty of air movement was possible it could be of relatively dense material.

The lower garment for the dry tropics should consist of heavy and durable slacks with a belt. For the humid tropics shorts with a loose waistband and straps over the shoulders were most satisfactory: a belt should not be worn, as this would interfere with convection and might cause a wet rubbing area round the waist.

Short socks were thermally preferable to long, and puttees were most undesirable as were anklets or any other source of restriction.

Boots and shoes should be comfortable for walking and durable, but as light as possible. Where the ground was hot the soles should be insulated.

Tropical flying clothing was the subject of separate studies. Material for a flying suit, in addition to feeling cool, being porous, sweat absorbent and as light as was consistent with toughness and durability, had to be capable of being flashproofed and impregnated against chemical warfare agents; it had to afford complete protection against mosquito bites, and have a smart appearance which it would retain after many launderings.

At a meeting of the F.P.R.C. held in December 1943 it was decided that Mark I of the R.A.A.F. tropical flying suit should be made in green herringbone twill, unless some more suitable material were found to be readily available. The committee also approved certain changes in design from previous light-weight flying suits. The suit was to be belted and less baggy in the seat; a battle-dress type of cuff was to be substituted for zippers on the legs, and removable towelling inserts used in the back until further data were obtained on the merits of attached underpants; the towelling at the wrists was to be retained but made removable.

Research on flying clothing continued throughout the war. At No. 1 F.P.R.U. Flight Lieutenant W. J. Simmonds made trials under controlled hot dry and hot wet conditions of the relative suitability of mercerised cotton and jungle green twill as a tropical suiting material. The results

showed that the twill imposed the greater burden on the subject's thermoregulatory mechanism, as gauged by sweat loss, pulse rate and rectal temperature. As the subject was kept fully hydrated and his shirt left open to the waist, conditions were by no means extreme, and it was considered that under more severe climatic conditions and when the subject was dehydrated, mercerised cotton would have an even greater margin of superiority over the twill.

The physical properties of the two materials, together with those of four others, were investigated at the Munitions Supply Laboratories. The mercerised cotton was found to compare very favourably with the others on most counts: it was only half the weight and thickness of the twill, and yet was almost as strong, and it was more comfortable, having a lower resistance to air flow. The possibility that this characteristic implied lower flash resistance was considered; the results of tests described in overseas publications suggested, however, that it should prove satisfactory. Its main disadvantage was that it afforded incomplete protection against mosquito bites, whereas the twill was excellent in this regard.

Clothing for aircrew who had to endure extremely low temperatures was the subject of special study. The principles adopted in designing such clothing were to provide an absorbent layer next to the skin to take up perspiration, several other layers in which air might be trapped, and an outside wind-resisting layer. The body had to be protected by wool and silk underclothing, and by a lined leather flying suit on top, the head by a lined helmet, and the feet by flying boots. The R.A.A.F. flying boots had black leather uppers reaching two-thirds of the way up the legs, with cross-straps for closure, and welted leather soles and leather heels. The boots were fleece-lined except for the inside of the sole, with removable inner soles fleeced on one side, and sufficiently loose fitting to allow several pairs of socks to be worn. The gloves at first issued in the R.A.A.F. had a silk inner and a woollen lining on the outside of the hand only: this afforded inadequate protection from the cold in below zero temperatures. The R.C.A.F. gloves had two inners of wool and cotton respectively, although normally only one of these was worn at a time. The leather of the Canadian gloves was softer and more flexible than that of the Australian, making it easier for the wearer to grasp small objects such as switches and pencils. The F.P.R.C. recommended that the Canadian glove should be adopted for use in fighter aircraft in which crews were exposed to extreme cold for relatively short periods.

Where cold had to be endured for longer periods, as in bomber aircraft, the Canadian gloves were considered inadequate. In fact, no clothing was effective for long periods against the extreme cold of high altitudes. Under those circumstances warming of the cabin air by heat transfer from the engine exhaust had to be provided. This form of heating was not practicable in fighter aircraft in view of the weight involved, nor could it help the rear gunner in bombers. For rear gunners electrically heated flying suits were needed. The Taylor suit was satisfactory, but there was some

uncertainty as to the parts of the body over which heating elements were best applied. It would seem theoretically that they should be applied over areas where thermal receptor nerve endings were scarce so as to minimise reflex sweating from local over-stimulation, but in practice particular attention was paid to the hands and feet where thermal receptors are plentiful.

Aircrew in the South-West Pacific zone who baled out or made a forced landing, coming down either in the sea or in the jungle, encountered conditions peculiar to this region. Experience gained in the European and Middle Eastern theatres was inapplicable, and a special panel of the F.P.R.C. was formed to work on problems of aircrew survival under tropical conditions. The sub-committee considered flying clothing which would provide protection not only against injuries which might be sustained in the aircraft, such as flash burns, but in the jungle where scratches and bites could quickly become infected. It also considered emergency packs of dehydrated and compressed rations, and special jungle kits containing items of equipment which would help the survivor to live off the jungle; these kits were intended to be attached to, or carried in the pockets of, flying clothing. The scope of the sub-committee's inquiry included instructions for aircrew on escape from aircraft by parachute, or, if a crash landing or ditching was possible, on methods of decreasing peak body deceleration, and thus minimising injury. Directions were also drawn up on first aid, on the measures to be taken against disease, on methods of combating fatigue, heat, cold and wet, and on the sustenance of life generally. The work of the sub-committee in this respect is described in detail in Chapter 30.

In the matter of equipment for casualty air evacuation aircraft—in particular, portable oxygen and litter fittings—Australia was largely guided by British and American policies.

As the war progressed the problem of fatigue in aircrew received increasing attention. Wing Commander R. H. Winfield, R.A.F., attempted to measure it by the accuracy of landfall by crews returning from operations, by the incidence of landing accidents and by the subjective feelings of aircrews. Other attempts at measurement were by psycho-motor tests. Contributing factors to fatigue in long flights were hypoxia, cold, discomfort, and sometimes the tension of a sortie deep into enemy territory.

In the R.A.A.F. the men who suffered most were the crews of long-range flying boats. Oxygen equipment had been removed from these aircraft before they reached the squadrons, and on occasions the crews were called upon to undertake two or even three flights with spells of less than 24 hours between; the flights often took as long as 20 hours, and a large part of this period was spent at altitudes of 10,000 to 15,000 feet. The flights were of three types—anti-submarine patrol and cover for convoys, supply drops and air-sea rescue and offensive strikes and minelaying. The first type, although often long, was usually uneventful, and everyone had

an opportunity to sleep; the second was of much shorter duration, but the third imposed a heavy burden on crew members, who found difficulty in remaining awake and concentrating on their given tasks, particularly in the later stages of a sortie. The captain and the navigator suffered most, the other members of the crew usually managing a spell on the bunk.

Winfield had reported favourably on the use of benzedrine to overcome fatigue in R.A.F. aircrew, but because of differences in the kind of operations carried out by the R.A.F. and the R.A.A.F. a separate investigation was made by Flight Lieutenant J. C. Lane to test the validity of Winfield's results in the R.A.A.F. situation.

In the investigation the captains of the aircraft were handed tablets for the crew before setting out, and the suggestion was made that they should be taken about one hour before the estimated time of arrival over the target, when parachute harness and Mae Wests were donned. In this way the benzedrine would be taking effect when post-target sleepiness would otherwise be appearing. Some of the tablets handed out were benzedrine and some dummies, so that psychological causes or mere chance could not be held to account for any benefit noted. The subjects, who were to some degree self-selected, since there was no compulsion to take the tablets, were questioned on their return. More than half of those who took benzedrine reported feeling some benefit. About one-fifth reported side effects of a minor nature—headache, increased fatigue or wakefulness when the effect of the tablets had worn off, nausea and vomiting, transient dizziness and diuresis. On the dosage recommended by Winfield, 10 mgm, there was no evidence of cumulative ill effects occurring. In an operational tour of about 60 sorties, even allowing for 30 offensive sorties on which benzedrine would be used, the amount taken in nine months would be only 300 mgm.

It was known that the drug caused rapid but transient decrease in the visual threshold of dark-adapted eyes, although this was not followed by subsequent reactive impairment of night vision. The flying-boat squadrons for whom the drug was intended were based on the mainland of Australia and were therefore not taking suppressive atebrin. It was of general interest, however, whether there was any theoretical or practical incompatibility between benzedrine and atebrin. Adrenalin, even in doses of 1 c.cm. of 0.1 per cent solution half-hourly for 12 hours had failed to precipitate malarial attacks in experimentally infected volunteers taking suppressive atebrin, and the possibility of benzedrine precipitating attacks therefore seemed very remote.

For use in squadrons the procedure suggested by Winfield was recommended, namely trial doses on the ground, the individual issue of each dose for in-flight use, and periodical review of the total amounts issued to each member.

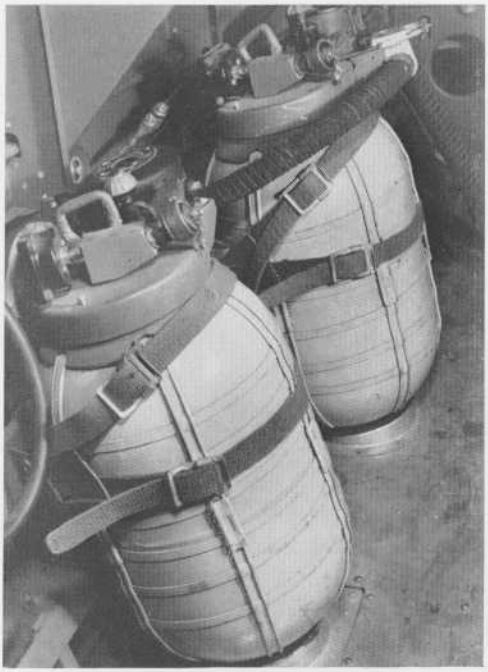
It was thought for a short while that exposure to the vapour of hydraulic fluid, K2/140, might have been responsible for certain hitherto unexplained fatal accidents. A number of aircrew members who had

inhaled the vapour reported alarming symptoms—irritation of the eyes and respiratory tract, heaviness in the head and feelings of disorientation or emotional instability; none, however, had lost consciousness. One of them, a trainee pilot, reported that, when ordered to dive on his instructor's aircraft, he had an impulse to ram it. Another, an experienced pilot, began to panic and prepared to bale out; he managed to regain control of himself but when he was landing he found that his reactions were very slow. It was apparent that resistance to the toxic effects of K2/140 varied greatly, and the D.G.M.S. instructed that its constituents, in vapour concentrations known to occur in aircraft, should be investigated at No. 1 F.P.R.U. The base of K2/140 was castor oil and the solvent, in the case of the fluid supplied to the R.A.A.F., was N-butyl alcohol.

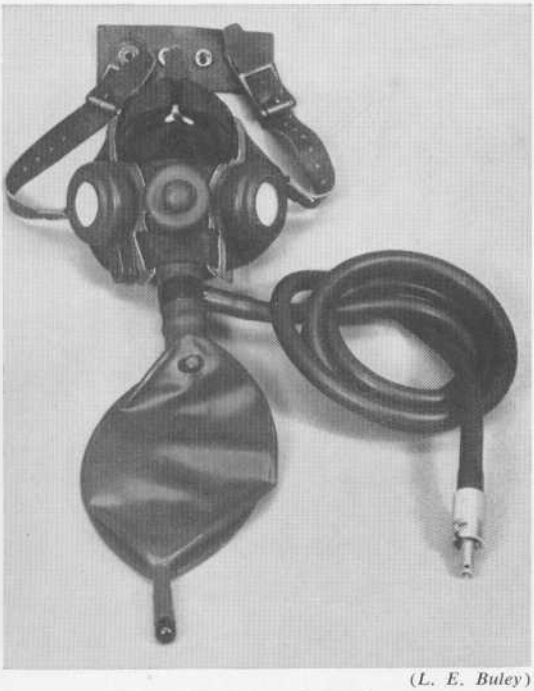
Experiments with animals both at ground level and at altitude indicated by analogy that N-butyl alcohol had a low toxicity to humans and was unlikely in any concentration to produce loss of consciousness. However, it was irritating to eyes and nose and was slightly narcotic, so that prolonged exposure might produce reduction in mental and reflex efficiency. It was therefore recommended that K2/140 should be replaced by a mineral-oil-based hydraulic fluid. Meanwhile, aircrew should be informed that the effects of the vapour were more irritating than dangerous; if the fluid did leak into a crew work-space, oxygen mask and goggles, if not already in position, should be donned, and the oxygen turned on fully. If oxygen was unavailable the crew should attempt partial exposure of their heads to the slip-stream, or, if this was impossible, maximum ventilation of the work-space should be obtained. In any case the aircraft should be landed at a suitable airfield as soon as possible. Buildings in which ground staff were working with K2/140 should be very well ventilated.

In R.A.A.F. dope and spray-painting workshops due precautions were taken to minimise the danger from the inhalation of other potentially toxic vapours. Nevertheless, an airman, who had been working for two months cleaning engine parts with kerosene and petrol after they had been removed from a cleaning fluid of high benzol content, died from agranulocytosis and thrombocytopaenia. From the post-mortem findings and the patient's history of exposure to benzol, it was concluded by Lieut-Colonel D. L. Barlow, and confirmed by Professor Cleland and Dr J. B. Thiersch, that the condition was one of benzol poisoning.

As a result it was considered that a full-scale investigation should be carried out at the larger workshops of the toxic effects of benzol and its homologues with the object of establishing whether the airman's case was attributable to personal idiosyncrasy or whether periodic haematological examinations should be made of all benzol contacts. The investigation was sponsored by the Director-General of Medical Services and carried out by Squadron Leader Mildred M. Hutchings, Flight Lieutenant Sheila M. C. Drescher, Squadron Leader McGovern and Flight Lieutenant F. A. Coombs. It covered the following aspects:



Portable oxygen sets carried in Mitchell aircraft. Contents — Pressure gauges, carrying handles, demand regulators and long leads for connection to mask are visible.



(*L. E. Buley*)

Standard lightweight oronasal continuous-flow oxygen mask, U.S. type, featuring 800 c.c. capacity rebreathing bag with moisture drain plug, and twin sponge-rubber inspiratory-expiratory flap valves at sides of face-piece.



(*L. E. Buley*)

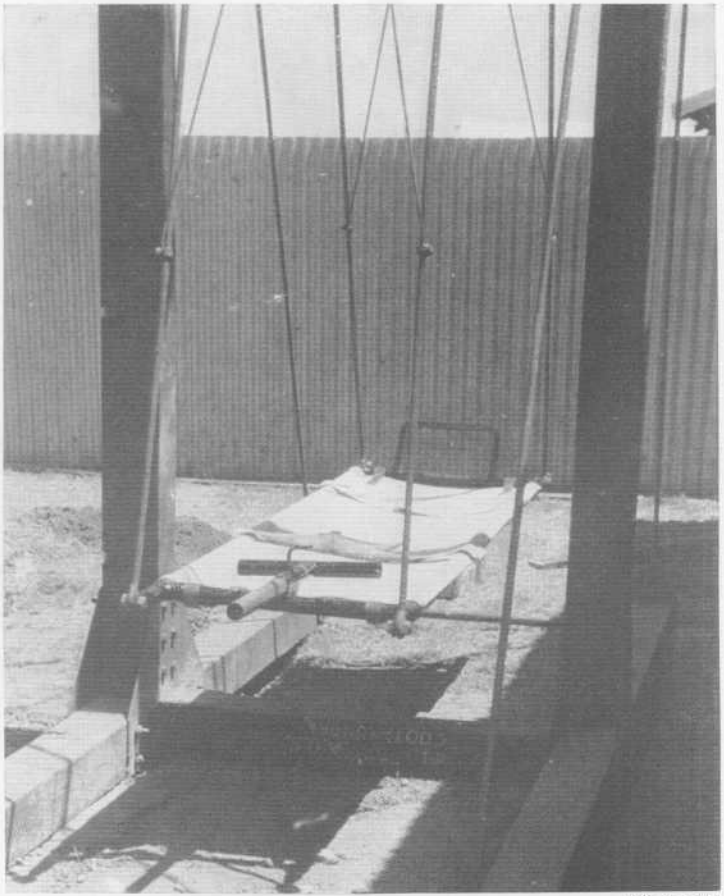
Airmen under instruction by a medical officer in a decompression chamber. Instructor wears R.A.F.-type mask with integral microphone, trainees B.L.B.-type masks with laryngeal microphones. Angled rectangular mirrors above trainees allow observation of all occupants by chamber operator.



(*L. E. Buley*)



Left: Flight Lieutenant K. V. Robertson wearing the Cotton gradient-pressure pneumo-dynamic anti-G suit. Pressure hoses lead from the G-operated valve connector in Robertson's hand to the abdominal and leg pressure bladders. *Right*: Testing the Cotton anti-G suit in a centrifuge designed for the purpose.



(*R.A.A.F.*)

Motion-sickness swing with close-up of stretcher, showing adjustable foot rest and safety straps.



(*L. E. Buley*)

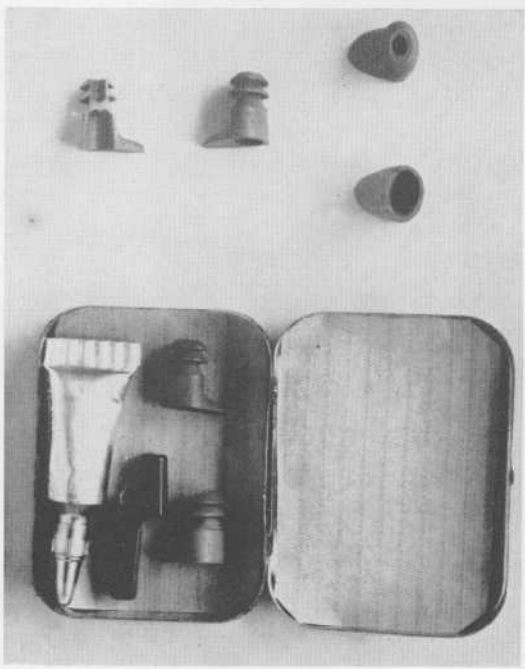
Experimental subject seated in car of vertical acceleration machine, viewed from above. Note wide padded retaining harness and improvised ankle restraint. Head restraint clamp at top of picture not in use.



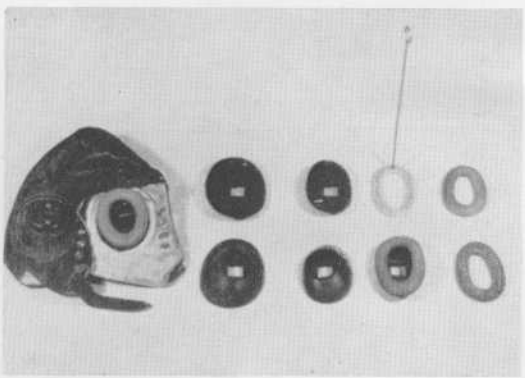
Headbands used in conjunction with earpads.



The Murray Speaking Tube System, featuring folded exponential horns and earpieces.



Earplugs designed by the Acoustic Testing Laboratory for protection against noise and blast.



Earpad and doughnut in R.A.A.F. helmet; two earpads with and without flange; aluminium doughnut former and complete earpad and doughnut; and two doughnuts.

(1) An analysis of the solvent fluids used by the air force, including benzol-containing materials; of toluol, xylol and other aromatics used in paint removers, and of acetate paint thinners used in dope, Duco, and spray-painting lacquers.
(2) An estimation of the aromatic hydro-carbon content of the atmosphere in R.A.A.F. workshops.
(3) An estimation of the inorganic/organic sulphate ratio in urine as a measure of the benzene absorbed by the lungs. This test was made only on those cleaning engines.
(4) An investigation of the blood state of those involved.

It was found that the sulphate content of the urine fell within the normal limits.

Interpretation of the haematological findings was complicated by a lack of agreement among world authorities on the criteria of benzol poisoning and the standard of normality. As there were no published Australian figures, a group of 300 controls, carefully selected to be comparable with the group of 587 contacts, was also examined. The two groups were compared statistically for haemoglobin values, red and white cell counts, colour index, neutrophil, eosinophil, lymphocyte, monocyte and platelet counts, haematocrit values, M.C.V., M.C.H. and M.C.H.C. While small differences were found in the haemoglobin, platelets, leucocytes, lymphocytes, M.C.H. and M.C.H.C. of the contacts and the controls, the blood pictures of the two groups differed so little that it was decided that there was no indication for routine blood examinations of contacts.

It was concluded that the airman who died from aplastic anaemia and thrombocytopaenia was unusually susceptible to the effects of benzol, but to guard against a like incident in the future certain recommendations were made about working conditions, and in particular the maximum exposure time that should be allowed.

During the war the F.P.R.C. published some 140 reports, which are listed in the appendix. They covered a wide field, and the research carried out led to improved methods of selection and training, and contributed to the health, morale and efficiency of aircrew and associated personnel and to their better prospects of survival both in the air, on the ground, and at sea.

Australia also kept abreast of the work being done on aviation medicine in other Commonwealth countries and in the United States. Brigadier C. H. Kellaway and Professor Cotton visited Canada in 1941 and the United States in 1942 to exchange information on aviation medical research. They were followed by two R.A.A.F. medical officers—Squadron Leader S. M. Morson in 1942 and Squadron Leader D. H. Le Messurier in 1943. In 1944 Group Captain Daley twice visited North America, where he established links with the Director of Medical Services, R.C.A.F., and the Air-Surgeon U.S.A. Air Corps and other medical authorities. As already mentioned, there was an Australian Air Liaison Office in Ottawa, and in April 1942 Squadron Leader R. V. Pridmore was attached as medical liaison officer. Canada was early in the field of

aviation medicine, and at the time of Pridmore's arrival research was being conducted there under the auspices of the National Research Council on a wide variety of subjects. The problems of Canada and Australia were not co-extensive because of the vast difference in climate, but on subjects of mutual interest information was freely exchanged to the advantage of both.

APPENDIX

FLYING PERSONNEL RESEARCH COMMITTEE REPORTS

F.R. 1: Minutes 19.12.40—
Aptitude tests for flying.
Eye and labyrinthine co-ordination tests.
Black-out.
Emergency rations.
Oxygen masks.
Colour vision.

F.R. 2: Minutes 27.2.41—
Progress of Researches mentioned above.

F.R. 3: Minutes 23.6.41—
Financial arrangements.
Construction of low-pressure chamber.
Progress of Researches:
(*a*) Flying aptitude tests.
(*b*) Depth perception.
(*c*) Eye and labyrinthine co-ordination tests.
(*d*) Black-out.
(*e*) Emergency rations.

F.R. 4: Minutes 16.11.41—
Financial arrangements.
Construction of low-pressure chamber.
Progress of above researches.

F.R. 5: "Proposed Machine for Training in Landings"—A. K. McIntyre, S. M. Morson.

F.R. 6: "Eye Movements and Their Relation to Depth Perception"—A. K. McIntyre, S. M. Morson.

F.R. 7: "How and Where to Look on Landing"—A. K. McIntyre, S. M. Morson.

F.R. 8: "Cockpit Lighting"—R. D. Wright.

F.R. 9: "Report on 'Black-out' Work at Sydney University"—8.1.42
(*a*) The centrifuge.
(*b*) Means of supplying a gradient of air pressure.
(*c*) The pneumatic suit.
(*d*) Tests in the air.

F.R. 10: "Notes on Airsickness"—A. K. McIntyre.
(*a*) Causes.
(*b*) Treatment.

F.R. 11: "Physical Co-ordination Flight Testing Equipment"—R. D. Wright.

F.R. 12: Report No. 2 on Black-out work at Sydney University.

F.R. 13: Report by Prof. Cotton on his visit to Canada, U.S.A. and U.K.—
(*a*) The Franks Suit, centrifuge and accelerator.
(*b*) The visit to Farnborough.

F.R. 14: Report on checkered pattern for flying training grounds.

F.R. 15: "Night Landing Machine"—S. M. Morson.
A night landing machine to demonstrate to pupils principles involved in landing along flare path.

F.R. 16: Minutes of Meeting 16.4.42—
- (*a*) Low-pressure chamber.
- (*b*) Featuring of aerodromes.
- (*c*) Flying aptitude tests.
- (*d*) Testing of Prof. Wright's mask.
- (*e*) Progress of Researches F.R's 5-12, F.R. 15, flying failure, carbon monoxide content of aircraft cabins, fatigue and colour vision.
- (*f*) Financial report.

F.R. 17: First report on pseudo-phoric landings—S. M. Morson.

F.R. 18: Survey of reasons for cessation of flying training in E.F.T.S's—S. M. Morson.

F.R. 19: Extracts from a report on Medical Scientific Mission to U.S.A., Canada and U.K.—Sept. 29, 1941-April 16, 1942, by Dr C. H. Kellaway.

F.R. 20: Report of Meeting held to discuss results of medical investigation into reasons for failure to learn to fly in the specified time, 17.6.42—
- (*a*) Improving methods of selection.
- (*b*) Improving methods of flying instruction.
- (*c*) Decreasing wastage.

F.R. 21: Minutes of 6th Meeting F.P.R.C., 16.7.42—
- (*a*) Testing Prof. Wright's oxygen mask.
- (*b*) Low-pressure chamber.
- (*c*) Black-out Work—University of Sydney.
- (*d*) As F.R. 20.
- (*e*) As F.R. 19.
- (*f*) Division of committee into sub-committees.

F.R. 22: Report on the work of the high-altitude training section, decompression chamber, Melbourne—D. H. Le Messurier.

F.R. 23: Low-pressure chamber for R.A.A.F. installed at University of Melbourne. Detailed description and explanatory notes.

F.R. 24: Abstract of Proceedings of Sub-Committee from 16th July to 21st September, 1942.

F.R. 25: Minutes of 7th Meeting, 1.10.42. Consideration of proceedings of—
- (*a*) High-altitude and carbon monoxide sub-committee.
- (*b*) Clothing sub-committee.
- (*c*) Ear protection, inter-communication and airsickness sub-committee.
- (*d*) Anti-G suit sub-committee.
- (*e*) Visual sub-committee.
- (*f*) Flying training problems sub-committee.
- (*g*) Fatigue sub-committee.

F.R. 26: Provisional recommendations of the visual and lighting sub-committee of the F.P.R.C.—
- (*a*) Windscreen.
- (*b*) Instrument panel.
- (*c*) Cockpit lighting.

F.R. 27: Abstracts of Proceedings of Sub-Committees, 22.9.42 to 1.12.42. Also appendices on Anti-G suits and Anti-G problems.

F.R. 28: Minutes of 8th Meeting of F.P.R.C., 11.12.42—Construction of airsickness lift.

F.R. 29: "Harrower-Erickson Multiple Choice Test—Preliminary Test"—D. F. Buckle.

F.R. 30: Abstract of Proceedings of Sub-Committees from 2.12.42 to 15.3.43.

F.R. 31: Minutes 9th Meeting, 26.3.43—
- (*a*) Injuries in aircraft crashes.
- (*b*) Welfare officers in forward areas.
- (*c*) Training in night adaptation.
- (*d*) Co-operation of F.P.R.C. with aircraft designers.
- (*e*) Reports on sub-committees.

F.R. 32: Report from R.A.A.F. No. 1 Clinical Investigation Section for 1942—
(*a*) The low-pressure chamber and indoctrination—D. H. Le Messurier.
(*b*) Operation and maintenance of plant—F-Sgt Ferguson.
(*c*) Psychiatric work—D. F. Buckle.
Appendix 'A'—Training in High Altitude Flying.

F.R. 33: Results of observations on night visual capacity tests in 9 Operational Group and N.E. Area—M. H. M. Ryan.

F.R. 34: Altitude tolerance study—D. F. Buckle and P. H. Cook.

F.R. 35: Report of C.A.A.G. Suit trials in Spitfire Mark Vc—K. V. Robertson.

F.R. 36: Notes on subjective effects of high centrifugal force—A. K. McIntyre.

F.R. 37: Report on 5th Meeting Fatigue Sub-Committee.

F.R. 38: Noise in Australian-built Beaufort Bomber—Eccles, Murray & Gardiner.

F.R. 39: Progress report on red lightings of aircraft: Report on the conversion of the instrument lighting on a Catalina flying-boat from the self-luminous to the red floodlighting system—C.S.I.R.O.

F.R. 40: Flight test "Cotton Aerodynamic Anti-G Suit"—S. J. Carr, R.A.F.

F.R. 41: "A memorandum on Some Problems Related to High Centrifugal Forces Acting on Man"—R. D. Wright.

F.R. 42: "Report on the Flight Tests of the Franks Flying Suit"—J. H. Harper.

F.R. 43: Acceleration tests in Spitfire Mark Vc, 15.7.43—K. V. Robertson.

F.R. 44: "Condition of C.A.A.G. Suit after 50 Hours Flying"—K. V. Robertson.

F.R. 45: Report on 3rd Meeting of Flying Clothing Sub-Committee, 11.5.43.

F.R. 46: Abstract of the Report of 8th Meeting of High Altitude and Carbon Monoxide Sub-Committee—11.5.43.

F.R. 47: Report on 4th Meeting Flying Training Sub-Committee, 18.6.43.

F.R. 48: Minutes 5th Meeting Motion Sickness Sub-Committee, 23.6.43.

F.R. 49: Minutes 6th Meeting Anti-G Problems Research Sub-Committee, 15.6.43.

F.R. 50: Anti-G Problems Research Committee. Meeting called to discuss arrangements to be made for constructing the new research centrifuge—16.7.43.

F.R. 51: Anti-G Problems Research Committee Meeting—16.7.43.

F.R. 52: Report on physiological performance and action of human centrifuges, as requested by Anti-G Sub-Committee—17.7.43—J. C. Eccles.

F.R. 53: Sub-Committee Anti-G Problems. Proposed scheme for training, etc., of aircrews and medical officers on the effects of acceleration.

F.R. 54: Special Meeting Anti-G Problems Research Committee—22.7.43.

F.R. 55: Conference at Victoria Barracks to discuss design of new centrifuge for research on acceleration—24.7.43.

F.R. 56: "The Influence of Certain Ocular States on Early Flying"—J. Ringland Anderson.

F.R. 57: Minutes 10th Meeting F.P.R.C.—6.8.43—
(*a*) Flying accidents.
(*b*) Consideration, proceedings sub-committees.

F.R. 58: Report on visual problems in Catalina squadrons—S. M. Morson.

F.R. 59: R.C.A.F. Flying Gloves—Job No. 88/A/22—J. H. Harper.

F.R. 60: Instructions concerning the rotating hexagon night vision testing apparatus (Australian model).

F.R. 61: Preliminary experiments on de-adaptation of red and white light at low intensity.

F.R. 62: "An Electric 'Reaction Meter' Suitable for Prolonged Performance Tests" —B. Katz.

F.R. 63: Abstract of preliminary report on "Cellosolve" toxicity experiments performed at No. 1 F.P.R.U., R.A.A.F.

F.R. 64: Minutes, 11th Meeting F.P.R.C.—16.12.43.

F.R. 65: Group Rorschach method. Report on its relation to R.A.A.F. selection problems—D. F. Buckle, W. H. Fraser and P. H. Cook.

F.R. 66: No. 1 F.P.R.U. Clothing Section. Minutes of Meeting 27.12.43.

F.R. 67: Correlation between Swing Sickness and Airsickness—A. K. McIntyre, I. D. R. Gardiner.
F.R. 68: Minutes of Meeting, Vision Section F.P.R.C.—17.1.44—
(*a*) Orthoptics.
(*b*) Night vision.
(*c*) Lighting of aircraft.
(*d*) Goggles.
F.R. 69: The relationship between visual acuity and flying ability—M. H. M. Ryan.
F.R. 70: Investigation into the effect of malarial suppressive drugs on altitude tolerance—S. L. Prescott and D. F. Buckle.
F.R. 71: "Effect of Anti-Malarial Drugs on 'G' Tolerance"—A. K. McIntyre, 28.4.44.
F.R. 72: "Effect of Anti-Malarial Drugs on Dark Adaptation."
F.R. 73: "Effect of Anti-Malarial Drugs on Susceptibility to Motion."
F.R. 74: "Report on the Toxicity of Hydraulic Fluid K2/140"—1.3.44.
F.R. 75: "An Electronic Aeroplane Noise Generator & Intercommunication Set for Training Purposes"—15.11.43—N. E. Murray.
F.R. 76: "The Assessment of Communication Efficiency in Noise"—22.12.43—N. E. Murray.
F.R. 77: "Ear Plugs for Protection Against Noise and Blast"—2.11.43—Eccles and Murray.
F.R. 78: Minutes, 1st Meeting Acceleration Section No. 2 F.P.R.U.—29.3.44.
F.R. 79: "The Present Status of Drug Therapy in Motion Sickness—Summary of the Literature"—W. H. Fraser, 28.4.44.
F.R. 80: Minutes Meeting of Motion Sickness Sub-Committee held in New Medical School, Sydney University—13.4.44—
(*a*) Pre-selection against airsickness.
(*b*) Emotional factor in airsickness.
(*c*) Vertical accelerator.
F.R. 81: Minutes, 3rd Meeting Oxygen Section—14.4.44.
F.R. 82: List of articles circulated to members as F.R's or reports during period 16.12.43 to 20.4.44.
F.R. 83: Minutes, 12th Meeting F.P.R.C.—20.4.44.
F.R. 83 (*a*): Experimental results on the amount of protection against G afforded by restricting C.A.A.G. Suit to "L.R.G.S.", plus a belt—F. S. Cotton, J. H. Tyrer.
F.R. 83 (*b*): Report from National Standards Laboratory—20.4.44—
(*a*) Fatigue of radar observers.
(*b*) Lighting of aircraft.
(*c*) Haemoglobinometers.
(*d*) Specification of aviation colours.
(*e*) Protective goggles.
F.R. 83 (*c*): Report on activities of Acoustic Testing Laboratory—19.4.44.
F.R. 84: The marking of aircraft instrument dials—E. H. Mercer.
F.R. 85: Report on captured Japanese equipment oxygen generator and changes from type I.S.S.F. Oscar. (Oxygen Section F.P.R.U.—1.4.44.)
F.R. 86: The effect of head position on susceptibility to motion sickness—A. K. McIntyre.
F.R. 87: The emotional factor in airsickness—W. H. Fraser, April 1944.
F.R. 88: Orthoptic testing and training flying failures. An analysis of results from No. 2 I.T.S. for Courses 34 to 41—N. G. Traylen.
F.R. 89: Use of benzedrine to overcome fatigue on operational flights of long-range flying-boat crews—J. C. Lane.
F.R. 90: Tests for determination of carbon monoxide intoxication of Ferry pilots in Boomerang aircraft—F-Lt Christie.
F.R. 91: Motion sickness—present status of research—A. K. McIntyre, June 1944.
F.R. 92: Preliminary report on K.O.P. Anti-G suits—A. K. McIntyre, June 1944.
F.R. 93: Present position of Anti-G suits—A. K. McIntyre, June 1944.

F.R. 94: Improved indicator scale—A.S.V. equipment—J. C. Lane, July 1944.
F.R. 95: Report on Anti-G equipment—J. H. Tyrer, K. V. Robertson, 13 August 1944.
F.R. 96: Report on decompression chamber runs conducted on army personnel experimentally infected with malaria suppressed by atebrin or atebrin and sulphamerazine—29.8.44—No. 1 F.P.R.U. in conjunction with Group Captain Baldwin.
F.R. 97: Flight trials of C.A.A.G. suit—K. V. Robertson.
F.R. 98: List of articles circulated to members as F.R's or reports during period 21.4.44 to 31.8.44.
F.R. 99: Minutes, 13th Meeting F.P.R.C.—31.8.44—
(*a*) Oxygen section.
(*b*) Clothing section.
(*c*) Chemical section.
(*d*) Psychosomatic section.
(*e*) Dental section.
(*f*) Malaria experiments.
(*g*) Report from No. 2 F.P.R.U. (F.R. 99B).
F.R. 99 (*a*): Report from National Standards Laboratory—31.8.44.
F.R. 99 (*b*): R.A.A.F. Activities of the Acoustic Research Lab.—29.8.44.
F.R. 99 (*c*): National Health and Medical Research Council—Fatigue Lab.
F.R. 100: Edgelit Range Scale—No. 1 A.P.U.
F.R. 101: Minutes, 14th Meeting F.P.R.C.—14.12.44.
F.R. 101 (A): Aviation medicine research in U.S.—general impressions.
F.R. 101 (B): Preliminary report on current activities of R.A.F. Physiological Laboratory, Farnborough—A. K. McIntyre.
F.R. 101 (C): Field investigation into the incidence of tropical fatigue (D. H. K. Lee, University of Queensland).
F.R. 101 (D): The future of aviation personnel research in Australia.
F.R. 101 (E): R.A.A.F. activities of the Acoustic Research Laboratory.
F.R. 101 (F): National Standards Laboratory—Report on inspection of tropical radar stations.
F.R. 102: Minutes of 2nd Meeting, Acceleration Section, No. 2 F.P.R.U.—15.1.45.
F.R. 103: Fatigue Laboratory—Secret Report No. 2—Effect of respirator (anti-gas) upon gun-sighting performance (D. H. K. Lee, C. White and G. Klemm).
F.R. 104: Report of tests on Type J.158 oxygen regulators.
F.R. 105: Report of tests on R.A.A.F. Type 1 oxygen regulator, S/No. 285—S. L. Prescott, 1 F.P.R.U.
F.R. 106: Tincture of iodine as a water-sterilizing agent—No. 1 F.P.R.U.—26.1.45.
F.R. 107: Minutes, 1st Meeting Acoustic Section 2 F.P.R.U.—30.1.45.
F.R. 108: Some factors in the protective mechanism of 'G' Suits—A. K. McIntyre, Nov 1944.
F.R. 109: Fatigue Laboratory—Secret Report No. 3. Psycho-motor efficiency (as measured by time for accurate gun-laying) under hot conditions—Lee, Klemm and White.
F.R. 110: Restricted category personnel recategorised after orthoptic treatment (First Report)—N. G. Traylen.
F.R. 111: A night division demonstration applicable to the decompression chamber —H. A. F. Rofe.
F.R. 112: Chemical Section No. 1 F.P.R.U.—Benzene hazards.
F.R. 113: The effect of ear drum protectors on the ear during descent from simulated altitude—H. A. F. Rofe, E. F. Norcroft.
F.R. 114: Fatigue Laboratory—Open Report No. 1—Physiological considerations in the development of tropical centres—D. H. Lee.
F.R. 115: Tropical flying suit trials—a comparison of green jungle cloth with mercerised cotton (AF. 8) as a tropical suiting material. Part 1—Physiological trials—W. J. Simmonds.

F.R. 116: Minutes, 15th Meeting F.P.R.C.—10.5.45.
F.R. 117: Fatigue Laboratory—Secret Report No. 4—The effect of tropical service upon some physical characteristics of R.A.A.F. ground crew. (*Second* report of field investigation into the incidence of tropical fatigue)—R. K. McPherson, D. H. K. Lee.
F.R. 118: The effect of tropical service on some physical characteristics of R.N.Z.A.F. ground crew—R. K. McPherson, D. H. K. Lee.
F.R. 119: Fatigue Laboratory—Secret Report No. 6—Surface brightness in the humid tropics—R. K. McPherson.
F.R. 120: Fatigue Laboratory—Secret Report No. 7—Temperature of stationary aircraft in the tropics—R. K. McPherson.
F.R. 121: Fatigue Laboratory—Secret Report No. 9—Some aspects of the incidence of skin disease in R.A.A.F. ground crew—R. K. McPherson.
F.R. 122: Fatigue Laboratory—Secret Report No. 8—The effect of tropical service upon the body-weight of soldiers—R. K. McPherson and P. B. McGovern.
F.R. 123: A psychological performance test for anoxia research—N. G. Traylen.
F.R. 124: Fatigue Laboratory—Studies of evaporation from an artificial 'skin' under service clothes—Lee, White and Kelso.
F.R. 125: The Murray speaking tube system—N. E. Murray, A. H. Pollard.
F.R. 126: Fatigue Laboratory—General aspects of tropical fatigue as seen in R.A.A.F. ground crew—R. K. McPherson.
F.R. 127: Fatigue Laboratory—Secret Report No. 10—Some aspects of the incidence of skin disease in R.N.Z.A.F. ground crew—R. K. McPherson.
F.R. 128: Report on high 'G' manoeuvres with American anti-G suits—K. V. Robertson, M. C. Cotton.
F.R. 129: The toxicity to flies of paints containing D.D.T.—D. Gilmour.
F.R. 130: Minutes, 16th Meeting F.P.R.C.—14.2.45.
F.R. 131: Design of earpad, helmets and headsets for acoustic efficiency in noise—N. E. Murray, A. H. Pollard.
F.R. 132: The effect of combatant patrol activities on some physical characteristics of A.I.F. infantry personnel—R. K. McPherson.
F.R. 133: Variations in human reactions to hot atmospheres as functions of temperature and humidity—preliminary report—McPherson and Lee.
F.R. 135: The effect of exposure to a humid climate on circulatory responses to postural change—R. K. McPherson.
F.R. 136: The effect of exposure to humid tropical climates on the resting pulse rate and arterial blood pressures—R. K. McPherson.
F.R. 137: Further considerations of the results obtained with the Harvard pack test in R.A.A.F. ground crew on tropical service—Lee and McPherson.
F.R. 138: Investigation of benzol and toluol poisoning in R.A.A.F. workshops—M. M. Hutchings, S. M. C. Drescher, P. B. McGovern and F. A. Coombs.
F.R. 139: The principles of clothing for hot environments—D. H. K. Lee.
F.R. 140: Atmospheric conditions encountered during a survey of R.A.A.F. ground crew on tropical service and their relationship to both sweat loss and the results obtained with the Harvard pack test—McPherson, Lee and Furlonger.

Chapter 29

EVACUATION OF CASUALTIES BY AIR

IN the war of 1914-18, the British, French and Serbians evacuated small numbers of casualties by air, using military aircraft in standard form or with minor modification only. In Australia, patients were first carried by air in 1922, one of the doctors sponsoring the project being Watson Brown. In 1926 the Australian Flying Doctor Service was established by Dr John Flynn, and with its development an increasing measure of medical security was brought to those living in the outback.

Counsell and Daley during 1928-1933 experimented with techniques to carry stretchers, Neil Robertson and others, inside and outside the fuselage of R.A.A.F. combat aircraft, including the Westland Wapiti and De Havilland types. Colonel R. Fowler (A.A.M.C.) was also impressed with the importance and potential of aircraft for the carrying of Service casualties.

The modern approach to military casualty air evacuation was pioneered by the Germans during the Spanish Civil War of 1936-38. Employing oxygen-equipped Junkers (Ju-52) transport aircraft carrying 6 to 10 litters, they flew their Condor Legion and other casualties home to Germany over the Alps, reaching altitudes of 18,000 feet and travelling on occasions 1,600 miles. On the outward flight to Spain these aircraft had carried troops or materials of war.

Techniques developed in the Spanish campaign were again employed in the invasion of Poland in 1939; men wounded in western Poland were in the operating theatres of base hospitals in Germany within two hours. In the Russo-Finnish war the Russians, adopting German practices, flew their chest-injury patients to a specially equipped hospital, manned by thoracic surgical teams, on the shores of Lake Ladoga. Many men who in previous wars would have died on the battlefield thus reached specialised surgical aid; the recovery rate achieved, approximately 80 per cent, contrasted more than favourably with the 50 per cent survival rate of similar British and French casualties of the 1914-18 War evacuated by surface transport.

At the outbreak of the Second World War, air transport of casualties was accepted in principle by the Allied powers. Implementation, however, met considerable difficulties arising from lack of practical experience of air evacuation techniques and a gross shortage of aircraft of all types. The shortage applied even more seriously to combat and logistic support aircraft than to civil types, and it was partially for this reason that specific air ambulance units using slightly modified civil transport aircraft, and engaged in casualty evacuation work exclusively, were first envisaged. The role of such aircraft in war had already been considered by the Geneva Convention, *Article 36* of which "guaranteed" immunity from enemy attack provided that:

(i) the conventional red cross symbol was displayed on specific surfaces of the aircraft, together with national insignia for identification;
(ii) operations of the aircraft were limited geographically; specific restrictions on flight over forward areas and enemy and neutral territories were laid down;
(iii) such aircraft were not employed for purposes of intelligence or transport of combatants or materials of war (medical supplies excluded).

Protection for aircraft crew, medical personnel and patients, in the event of descent in enemy or neutral territory, was also provided for by the Convention. In practice, however, even with the best of intentions on both sides, immunity from attack was uncertain, the chief reason being that the red cross markings were on occasions not visible to attacking pilots before the attack was launched.

Under these conditions specific air ambulance units were formed in the R.A.F., the South African Air Force and, as No. 1 and No. 2 Air Ambulance Units, in the R.A.A.F.; the Australian units operated in the Middle East, New Guinea and Australia. They rendered excellent service in a limited way, transporting casualties and medical supplies. No. 1 R.A.A.F. Air Ambulance Unit conveyed about 9,000 patients during the Middle East campaigns, in the course of which two of its aircraft were shot up.

Among the disadvantages of specific air ambulance aircraft—and indeed intrinsic in the air ambulance concept under the Geneva Convention—was the limitation of role imposed both by international agreement and by the physical fact that they were, as already mentioned, largely aircraft unsuitable for other military purposes. As they did not fit into the equipment pattern of operational air forces, their maintenance and spares services had to be specially provided. For these reasons they were a militarily uneconomic proposition between engagements.

The New Guinea campaigns of 1942 produced numerous sick and wounded, and the ambulance aircraft available to fly them back over the Owen Stanleys were few and of inadequate capacity. The alternatives to large-scale air evacuation were impracticable, with the sea coast controlled by the enemy and land travel along the Kokoda Trail on the shoulders of native bearers too rigorous. It was against this background that casualty air evacuation of necessity entered a new phase. In areas where hostilities were characterised by rapid advances and withdrawals airstrips were set up or recommissioned and almost immediately military transport aircraft would land on them with reinforcements, ammunition and supplies. Sometimes the airstrips were so far forward that fighting was still continuing on the perimeter as the transport aircraft came in to land. As many casualties occurred near the strips, the practice developed of using transport aircraft to evacuate them, and it sometimes happened that troops would return as battle casualties in the same transport which brought them.

Unfortunately this sudden need to transport large numbers of sick and wounded men by air caught the Australian and American medical services unprepared. They had no organisation or medical personnel available for caring for patients in flight. Air evacuation without specially-

trained medical escorts was attended with many difficulties, yet it was only on rare occasions that a medical officer was present even to superintend loading and to instruct the crew what to do for seriously wounded men in an emergency; one pilot stated that in 200 trips he carried a medical attendant only twice. This meant that in many instances the aircraft crew had to attend to patients in the air. Chest cases, which were carried lying flat, had to be given morphia obtained from the emergency crash kit of the plane. At this early stage no medical kit or oxygen were carried for these cases which were often taken to altitudes of 12,000 to 15,000 feet. On many occasions pilots, even though they were carrying full loads of patients, indulged through ignorance in elaborate "peel offs" when they reached the other side of the range, an unnecessary procedure except as an evasive tactic when under attack.

Patients were often improperly prepared for flight. Some would be taken aboard the aircraft with their clothes, which consisted only of shirt and trousers, soaked from a tropical downpour. With the temperature dropping 2°C. per 1,000 feet of altitude they rapidly froze. Frequently there were only sufficient blankets to allow one to be supplied to each stretcher case and sometimes not even this. At this period military transport aircraft had no cabin heating. In the absence of medical supervision, alarming incidents occurred. There was for instance the case of the psychotic patient who wandered up to the cockpit, grabbed the pilot's loaded revolver, and threatened him with it. Distracted by the cries of a badly wounded man, he forgot the pilot, but attacked the wounded man, with unfortunate results.

Owing to the lack of coordination between transport and movements sections and medical sections, aircraft were often held up on forward strips to wait for patients, where they made easy targets for enemy strafing. Nevertheless, under these conditions 13,000 patients were carried in 70 days.

Soon after the Gona-Buna-Sanananda campaign No. 804 U.S. Medical Air Evacuation Transport Squadron arrived in New Guinea. Squadrons of this type were designed for the mass movement of casualties by military transport aircraft, and orders were given that air evacuation should henceforth be the responsibility of the air forces and under the control of the medical air evacuation transport squadrons. No. 804 Squadron, composed of 5 doctors, 25 sisters and 25 orderlies, together with necessary supporting personnel, was soon in full control of all New Guinea medical evacuation.

With the 7th Australian Division fighting its airborne campaign in the Markham and Ramu Valleys and the 9th Division progressing along the coast from Lae to Finschhafen, the air evacuation of wounded became too big a task for this one squadron. The R.A.A.F. Medical Service was asked to cooperate and an R.A.A.F. medical officer and 12 orderlies were posted to No. 804. Subsequently wounded were evacuated at the rate of approximately 125 a day from each division to the base hospitals at Dobodura and Moresby. The day after the first transport landed on the

newly prepared strip at Finschhafen 478 patients were flown out to relieve the congested 9th Division hospitals. In one morning 25 aircraft, with medical attendants of the air evacuation squadron travelling on each, moved them to Moresby. In those days fighter escort was provided.

After working for two months with the Americans the R.A.A.F. decided to form its own medical air evacuation transport unit. Thus No. 1 M.A.E.T.U., which was half the size of the American unit, came into existence in March 1944. The sisters and orderlies were put through a comprehensive training course in Melbourne and the unit became operational in July 1944, working in conjunction with the American squadron at Nadzab. It was commanded by Squadron Leader F. W. Kiel.[1]

After that time all the Australian evacuations for the First Army, both within forward areas and from operational areas to the Australian mainland, were carried out by this unit. In late 1944 No. 804 Squadron moved on with the American Army to the Philippines, and No. 1 M.A.E.T.U. then became responsible for both Australian and American evacuations in New Guinea. On one occasion when the American Air Transport Command air evacuation unit was short of personnel for its trans-Pacific evacuation to America four of its C-54 transports were medically staffed by members of the Australian unit. In the course of its existence No. 1 M.A.E.T.U. carried more than 14,000 cases without a single loss in flight.

When a second M.A.E.T.U., No. 2, was formed it was based at Morotai. No. 2 M.A.E.T.U., commanded by Flight Lieutenant G. F. Salter and later Flight Lieutenant V. W. Potter, handled all air evacuations for I Corps, as well as all R.A.A.F. and R.A.N. evacuations. The personnel of Nos. 1 and 2 M.A.E.T.U's did not operate any farther south than Townsville, where a third medical air evacuation unit, No. 3, was based. The flight teams were changed there, personnel of No. 3 M.A.E.T.U. taking over and escorting patients to Brisbane and other points south.

In air evacuation of casualties transport aircraft of many types were eventually used. Flying-boats such as Sunderlands, Catalinas and Mariners carried out evacuation from newly-taken islands where the old strips had not been repaired or new ones built. Four-engined Douglas C-54's were used by the Americans for trans-Pacific flights, but the aircraft most frequently used was the two-engined Douglas C-47—or Dakota—which did more than 90 per cent of the Australian medical evacuation work in the S.W.P.A. This aircraft was at first fitted out with metal litter brackets and could take 18 stretcher cases. Webbing suspensions developed later enabled 24 cases to be carried in American litters; or 19 in British or Australian litters.

In the European theatre of war, where evacuations were only a matter of a few hours or even minutes, W.A.A.F. nursing aids accompanied the patients; in the Pacific, with rugged flying conditions and the long dis-

[1] Much of the material for this chapter has been taken from the article "Air Evacuation of Casualties" by Squadron Leader Kiel in *Medical Journal of Australia*, pp. 97-104, 25 Jan 1947.

tances to be covered, where a flight might be equivalent to a day or more of hospitalisation, sisters and well-trained senior medical orderlies were considered necessary. The practice was for aircraft of the regular transport squadrons flying troops, munitions or other supplies to the forward areas to take one sister and one medical orderly of the M.A.E.T.U. This team would then care for the patients back-loaded on the aircraft from the forward area.

The medical air evacuation unit classified the air evacuees, superintended the loading of patients, provided medical care during flight and superintended the unloading. The Services requiring evacuation were responsible for collecting their cases and for providing shelter and medical treatment at the points of emplaning and deplaning. This was done efficiently at Nadzab where the army built a 200-bed strip-side hospital purely for staging patients flown in and out of the area by the R.A.A.F.

If the availability of aircraft was good, all cases could be evacuated without delay, but where this was not so or where more than one hospital or Service had requested evacuation, the allocation of priorities as between all patients requiring evacuation fell to the lot of the M.A.E.T.U. medical officer.

The M.A.E.T.U's had on detachment at headquarters in all the main fighting areas sergeants who went in at landings just before the strip became serviceable, for the purpose of liaison with the army medical services. At the appropriate time they signalled to their parent units the number and classification of cases awaiting evacuation and other relevant information. The orderly rooms at the parent units then arranged with the transport squadrons what aircraft would be allotted to the task and signalled this information to the sergeant on detachment.

When an aircraft flying in an M.A.E.T.U. team was one hour distant from its destination, its estimated time of arrival was radioed forward. Thus the despatching medical unit could arrange for patients to be available for loading at the strip with a minimum of waiting in ambulances under hot or humid conditions.

The nominal rolls, X-rays and medical documents of the psychiatric cases were handed over to the sister; other patients had their field medical cards attached to their shirts. Medical documents were never given to psychiatric patients as they invariably tried to read them, to their own disadvantage. With the nominal rolls as a guide the sister checked all patients in the ambulances, noting their condition, the restraint necessary for psychotic cases, and ensuring that all pre-sedations were marked on the medical cards. Meanwhile the medical orderly had fitted up the plane ready to receive the litters. The sister then superintended loading of the patients in the most advantageous positions.

Stretcher cases were if possible loaded head foremost towards the front, the rationale being that near the aerodynamic centre of the aircraft the effects of air turbulence were less disturbing than was the case towards the tail. The heating system was also more efficient in the front. Those cases which were likely to need most nursing attention were placed in

the lower positions so as to be more readily accessible and to allow a greater "head" of fluid under gravity above the recipient if intravenous therapy had to be given.

All stretcher cases were given three blankets and walking cases at least one, as it was sometimes necessary to fly at 18,000 feet, where the aircraft heating system failed to be effective and the cold was intense. It was interesting to note that patients said their extremities became warmer when oxygen was given, probably because it increased metabolism.

Customarily, chest cases were loaded right forward in the lowest litter position so that pillows stacked against the forward cabin bulkhead could be used to maintain a semi-Fowler's position. The litter position second from the bottom could be left unfilled to make room. Some medical officers, however, preferred loading chest cases at the tail of the aircraft for reasons connected with cabin air movement in flight. With fractures it was often more comfortable for the patient to have the injured limb suspended from the litter above.

After the litter cases were loaded their kit was stowed under the seats, 20 to 30 pounds being the maximum allowed to each patient. Walking cases then took their seats.

Before take-off a check had to be made to ensure that:

(*a*) all wounds and fractures were adequately supported and all wounds recently dressed;
(*b*) T.B. chest cases were wearing a gauze mask, and psychotic cases had been properly sedated and restrained;
(*c*) all cases had recently voided and if possible emptied their bowels, and those needing catheterisation had been attended to; and
(*d*) a light meal with adequate fluids had been taken.

The importance of thoroughly checking all patients before departure was demonstrated by the case of a patient who had been diagnosed as suffering from skull injury with brain prolapse. The forward clearing hospital had missed the fact that he also had five bullet holes through his abdomen. Another listed as "skin" was found to have had an appendicectomy the day before.

On take-off the sister and orderly reassured those patients who had not previously flown, and kept a watch to ensure that litters did not slip. The sister would then make out her flight forms from the nominal roll, recording on one of them details of pre-sedation, the reactions of patients during flight, any in-flight treatment, and other relevant points. The pulse and respiration rate of all patients were taken, and the body temperature where indicated.

Early morning flying was by far the smoothest, so stretcher cases liable to be upset by bumpy weather were dispatched on early aircraft. Walking cases could be sent out later in the day. Flight near the ground in the tropics was usually bumpy because of thermal effects, and a high flight was usually a smooth one. The sister always indicated to the pilot whether the trip should be a high smooth one, as desirable for cases such as recent fractures and renal calculus with colic, or a low, if

rougher, one for chest cases, severe anaemias, cardiacs and cerebral injury cases. When several aircraft loads had to be evacuated from one place the dispatching medical officer compiled his loads so that cases expected to travel better at a low altitude were not mixed with those for whom higher-altitude travel was indicated. Patients suffering from *otitis media* travelled quite well provided the ascent and the descent were gradual. If a sister thought the flight altitude was becoming too great for her patients, she would advise the pilot to this effect. In an emergency such as the sudden collapse of a patient she would have a signal sent to the nearest landing strip with medical facilities predicting arrival and requesting the presence of a medical officer. It was the sister's duty to keep a check on the altitude at all times, and to chart it on the flight form.

A comprehensive medical kit was carried by flight teams. A plasma infusion set was essential. On the few occasions this was used in the air it proved a life saver. Hypodermic syringes, 10 ccm and 2 ccm, used in the administration of intramuscular penicillin and intravenous sodium amytal, and numerous other items such as rectal tubes, pans, urinals, thermoses and catheters were always carried. Portable oxygen equipment was an essential piece of apparatus and saved lives on numerous occasions. The system most favoured was a low pressure 1,150 litre bottle at 500 p.s.i. pressure with a pressure/contents gauge and a flowmeter indicating in litres per minute up to 6. The face mask used was a B.L.B. type with a rebreathing bag.

When an evacuation aircraft was within about half an hour of its deplaning point, the base was advised by radio of its imminent arrival and of the number of ambulances required. The aircraft was unloaded under the supervision of the medical orderly and sister. The receiving medical officer discussed the cases and their treatment with the sister after perusing the flight forms, which finally passed to a clerk for statistical purposes.

The possibility of a crash-landing was not overlooked. In forward areas each member of the crew wore full tropical equipment and carried a full water-bottle, flying rations, survival kit, steel helmet and revolver, while on flights over water "Mae Wests" were also carried. Every fortnight flight crews were briefed by an army liaison officer on the tactical situation, forward enemy positions and escape routes. The instructions of the sister and medical orderly in the event of an impending crash-landing were to behave in a calm, reassuring manner and to give their orders clearly. All loose gear, baggage and medical kit were to be thrown overboard, with the exception of some selected drugs which were to be saved if time permitted; this was feasible in view of the presence of a comprehensive medical kit in the rubber dinghy. If over land, the double doors of a Dakota could be jettisoned in preparation for rapid exit. Over the sea, however, the doors had to be retained, since if touch-down were made in the desirable tail-down attitude the aircraft would otherwise rapidly flood.

If there were time, all stretcher cases were turned round so that their feet and not their heads faced the direction of flight. Restraint straps were

applied under arms and across the body, and instructions were given to hold on tightly. The sister and the navigator or co-pilot then went into the lavatory compartment and stood with their backs against the bulkheads on either side of the door, which was left open to prevent jamming, and their hands clasped behind their necks for additional support. The captain, remaining at his controls with restraining harness adjusted, jettisoned the escape hatch in the roof of the cockpit and sounded the "bale-out bell" —if the aircraft was so equipped—as a warning to all personnel an estimated 30 seconds before ditching. The wireless operator, having radioed the aircraft's ditching position, took station with the medical orderly in the navigation compartment, their backs braced against the forward bulkhead.

If landing on water, Mae Wests were put on but not immediately inflated as the rubber bladder could burst due to a sudden blow on touchdown, or egress through an escape hatch might be obstructed, if such had to be used for escape. When the aircraft had come to rest the navigator or co-pilot and sister immediately inflated dinghies on the water. The sister superintended the loading of patients, placing the most serious cases in the dinghy to be occupied by herself. Walking cases filed out so as not to block the unloading of the stretcher cases, which was usually carried out by the medical orderly and wireless operator, the captain helping if he were able. Stretchers were left behind unless absolutely necessary.

Of all casualties evacuated by air in New Guinea 15 per cent were psychiatric cases. It became necessary ultimately to define three categories of psychiatric: serious mental litter, mild mental litter, and mild mental walker. In practice, categorisation was based on the diagnosis submitted by the dispatching hospitals on the manifest—this was sometimes faulty, as prolonged study of these cases was not possible in forward areas.

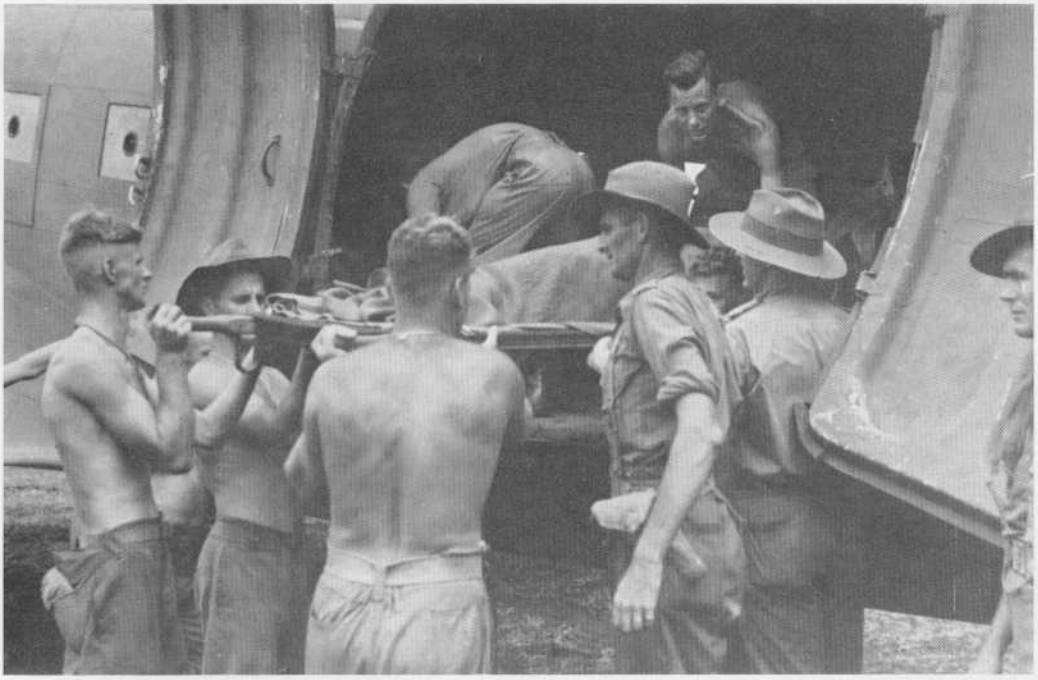
Throughout the records of psychiatrics there were frequent notations by the flight nurses to the effect: "physical condition poor", "marked dehydration" or "state of exhaustion". In the period before admission to hospital mentally disturbed men, labouring under mental conflicts and frustrations, might be over-active, sleep poorly and fail to eat and drink regularly or adequately. In the discomforts and dangers of army life in forward areas their condition would often go unnoticed until it had reached an advanced stage. Thus many of the mentally disturbed men arriving at advanced hospitals were in poor physical condition. Because of the problems involved in their care these hospitals were glad to evacuate them as soon as possible; thus they often arrived at the aircraft unfit to withstand the stress of a long flight.

It was found that patients who had had a course of treatment such as cardiazol travelled infinitely better than those who had not. On occasions flight sisters travelled from forward areas to Lae with serious mental cases who reacted unfavourably to flight, having been poorly prepared by the hospitals concerned. Some weeks later these sisters evacuated the

same cases to the mainland after they had received treatment at Lae. Many commented on how well the patients then travelled.

Illustrative of the dangers involved was the alarming experience recorded by a flight sister who, against her better judgment, accepted for evacuation a psychotic patient who had been inadequately prepared. The patient, who was in an emaciated condition, had been wakened at 1 a.m. and, without being given food or drink, had been brought to the strip for 5 o'clock take-off. He was restrained by rope that had frayed right through his pyjama coat and broken the skin underneath. He smelt of paraldehyde, but on examining his documents, the sister discovered that there was a blank sheet for the last three days of hospitalisation. As he was struggling violently, she surmised that the sedation was insufficient, and gave him sodium amytal gr. 6. However, the hospital sedation had apparently been given late and had been ineffective up to the time of emplaning, with the result that one hour after take-off the patient collapsed and could not be roused. His breathing was shallow and he became cyanotic, with a rapid, thready pulse and clammy skin. The sister immediately applied oxygen, gave intramuscular coramine and requested the pilot to descend to 500 feet. The patient improved somewhat but was in a very unsatisfactory condition on arrival at his destination. The sister had radioed for a medical officer to meet the plane with plasma, which was given to the patient before his removal to a hospital. Such poor preparation of a patient was only too frequent in some of the forward areas.

The sedative drug of choice was sodium amytal. Intravenous administration just before loading the patient on the ambulance was favoured, as this produced sedation more rapidly and was more predictable than the same drug given perorally or other sedative drugs administered by any method. For any further sedation required en route oral sodium amytal or "Nembutal" in small doses was usually employed. For one-third of the psychiatric cases carried it was necessary because of their disturbed condition in flight to give further sedation. When considerable resistance was met further intravenous sodium amytal was the only answer. It was found that in general morphia was unsatisfactory given either prior to or in flight, as in severe cases the dosage required to bring about the desired degree of hypnosis was so suppressive to the respiratory centre as to be dangerous. Paraldehyde was useful as a sedative if given rectally. When given orally the result was deplorable to all concerned if the patient became air sick soon after take-off. Patients who refused sedation in the air could make it impossible to give this drug rectally. Intramuscular injection was not generally favoured, although good results were obtained using this method combined with sodium amytal. Some cases could resist high dosages of sedative drugs. For example, one man awaiting embarkation on the strip was still raving and struggling half an hour after the administration of 28 grs. of sodium amytal; needless to say, he was of extremely strong physique. Evipan sodium was not considered satisfactory.



(*Australian War Memorial*)

Loading a stretcher case into a Dakota at Nadzab.



(*Australian War Memorial*)

A wounded soldier from Kokoda arrives at Port Moresby by Stinson ambulance aircraft.



Senior Sister B. Bray and a nursing orderly, Sergeant Dawson, attending to patients on board a medical air evacuation aircraft.

Many patients who had been wrongly categorised as "serious mental litters", were released from restraint by the flight sister and travelled satisfactorily sitting up in a normal manner. The opposite also occurred: walking cases on occasion became violent in the air and had to be restrained. An interesting point was that often a fractious mental patient responded to orders from a fellow psychiatric when all requests for cooperation by the sister and orderly had been unavailing.

It was found that the use of the straight-jacket was inadvisable, as was the use of tight clothing and blankets. These could lead to dehydration, which in this theatre of war had to be avoided at all costs, especially in psychotic cases. Cabin temperatures up to 150°F. were registered in Dakotas which had been standing for an hour on a strip at midday. Because of this it was necessary for patients to be loaded just before take-off, and if there was a break in the journey, to be removed and placed in the shade during the waiting period. Just before take-off copious fluids were given, intravenously if necessary. The best means of restraint for maniacal cases was found to be straps of soft material, such as triangular bandages or towels; the friction generated by a patient in his struggles against restraining webbing or rope could cause severe abrasions. Ordinary cotton bandages, even though of many thicknesses, tended after continual struggling to become rolled and also injure the skin.

Patients with chest conditions travelled remarkably well with the correct management. Oxygen was essential if the aircraft had to ascend to even moderate altitudes. On one flight during which weather conditions made it necessary for a height of 19,000 feet to be maintained for an hour and a half, there were two chest cases from the Borneo fighting aboard, one a post-pneumonic empyema, who with the aid of oxygen stated he felt no ill effects except for a headache, and the other a case of gunshot wound of the chest with fractured ribs, torn diaphragm and lacerated liver, and in addition a through-and-through wound of the right buttock. He was somewhat cyanosed, but not excessively so, and had some chest pain.

On the same flight were two heart cases, both with aortic regurgitation. These became more cyanosed than any other patients on the flight but were not severely distressed. R.A.A.F. experience in evacuation of various types of cardiac cases, including coronary thromboses, supported the contention that the seriousness of the effect was a product of the reduction in ambient pressure, the duration of exposure and the degree of cardiac impairment. The type of lesion was not as important a factor as the cardiac reserve, nor the increased demand on the heart as deleterious as anoxia of the heart muscle.

Asthmatic cases thrived on altitude. The higher they ascended the better they felt, and the less laborious was their breathing.

Air evacuation of patients with severe coryza was found to be inadvisable, except in emergency. When such cases were evacuated, pneumonia sometimes followed, and sometimes *otitis media.* Air evacuation of acute lobar pneumonia was also contra-indicated. The flight sister escorting a

case of pneumothorax had to remember to advise the pilot that a slow ascent and descent were desired.

Cases of bacterial endocarditis, severe malaria, leukaemia and all types of anaemia travelled well, given adequate supplemental oxygen.

Scrub typhus cases often became unduly anoxic at high altitudes but revived on administration of oxygen and descent to lower levels.

Head injuries had always to be carefully watched as even moderately severe cases did not travel well unless oxygen was given, signs of hypoxia often appearing at altitudes as low as 5,000 feet. Schnedorf and his co-workers demonstrated that cerebral concussion with or without skull fracture caused depressions of arterial blood oxygen concentration ranging from 5 to 44 per cent. Oxygen therapy minimised pyrexias of central origin and restored blood oxygen saturation to normal. Acute head cases evacuated in forward areas often had continuous oxygen for the whole journey. It had to be remembered that release of gases from solution in cerebro-spinal fluid became significant at altitudes of 12,000 feet and above, adding to the high intercranial pressure already manifested in most head injuries.

Recently repaired abdominal wounds involving the gut travelled well, providing an altitude at which reduction of barometric pressure induced undue expansion of bowel gas was not reached. Such expansion could cause severe colicky pain and disruption of sutures.

Patients were not nearly so prone to airsickness as might have been expected. On one occasion when a mixed load of patients and troops was carried not one of the patients was sick and all enjoyed watching the sister ministering to the unhappy troops. Probably the supine position of litter cases had much to do with this. One flight sister who recorded that she had few cases of airsickness over a period attributed this to the fact that she always watched for the first symptoms of agitation and uneasiness and when these appeared immediately commenced treatment, which consisted of loosening all tight clothing and administering glucose and 1½ grs. of luminal. Oxygen relieved many cases of impending airsickness and was used as a routine by some sisters.

Generally speaking, air evacuation proved to be the ideal method of transporting wounded and was economical of time, personnel, transport and material. The shorter time involved—a Dakota travelled approximately 10 times as fast as a hospital ship—reduced medical requirements and complications in transit. It was estimated that the transportation of patients by air required 21 times fewer personnel than were required to transport the same number of patients by sea. This estimate was made on the basis of an aircraft requiring only 30 to 70 patients to make a full load as against 300 for a hospital ship. Because air trips were more frequent, fewer holding hospital beds were required in advanced areas—provided the casualty rate was relatively constant and within the capacity of the evacuation facilities available—and these areas could be cleared of sick and wounded with less delay for the majority of cases.

When mass evacuation of casualties was first planned it was thought that there would be many kinds of medical conditions which would preclude safe movement of the sufferers by air. This was disproved by experience. With a few exceptions, even seriously ill men could be moved safely, given some preparation and adequate in-flight attention by trained medical personnel. Where the forward hospitals were well established and relatively immune from enemy attack by virtue of Allied air superiority, however, there was no need to hurry the evacuation of men who were in a shocked condition or would be improved by a few days' treatment in hospital. Only occasionally, as in the Buna campaign, when the war situation was not predominantly in our favour, were men moved who required plasma or other resuscitative treatment en route. Classes of cases which were evacuated urgently included eye injuries, brain injuries and those requiring plastic surgery; the prognosis of all of these was improved by removal to the specialised care and treatment available in the big base hospitals on the mainland.

Air Evacuation of Recovered Prisoners of War. When the war with Japan ended in August 1945 Australian prisoners of war, numbering about 14,400, were widely scattered in camps on Singapore Island and in Johore, in Thailand, Burma and French Indo-China, on the islands of the Netherlands East Indies—including Java, Sumatra, Ambon, Celebes and Bali, at Kuching in British North Borneo, in Japan, Korea and Manchuria and on Hainan Island. Plans had been made for their repatriation long before the armistice was signed. At the end of 1944 the Pacific commands—the Australian Army, South-West Pacific Area headquarters and South-East Asia Command (S.E.A.C.)—had each been made responsible for recovering Allied prisoners of war in their respective zones and for bringing them to given concentration points. An organisation known as Repatriation of Allied Prisoners of War and Internees (R.A.P.W.I.), was created to look after the prisoners at the concentration points, where they were to be retained for medical treatment and clearance, kitting, interrogation, documentation and pay. The final stage of repatriation, the transportation of the prisoners to their homelands, was the responsibility of the Allied country concerned.

The Australian Army was responsible for recovering prisoners from Rabaul, the Moluccas, Borneo, Timor and Celebes and other islands to the east of Timor, and for transporting them to Morotai, one of the concentration points, where the 1st Australian Prisoner of War and Internee Reception Unit had been established since June. As well as troopships and hospital ships, Australia had aircraft ready for the task, and it was necessary that full use be made of them as many of the prisoners were seriously ill, and might die unless transported quickly to hospital. It was decided that most of the experienced escort personnel from No. 1 M.A.E.T.U. at Lae and the air evacuation unit at Townsville should be sent to No. 2 M.A.E.T.U. at Morotai, and from the pool thus formed the requirements of the various sectors could be met. Squadron Leader F. W. Kiel arrived at Morotai on 9th September to take his part in

operations. Meanwhile, No. 2 Air Ambulance Unit was detailed to provide a service of one air ambulance aircraft each week between Brisbane and Morotai, the aircraft to go forward with Red Cross supplies and to return with patients.

At Morotai about 1,000 army patients at the 2/5th and the 2/9th A.G.H's were sent to Australia by air, with medical air evacuation escorts where necessary, to make room for the incoming prisoners. These soon arrived, R.A.A.F. transports bringing in about 700 from Kuching. Most of these were taken off by hospital ship. The small number remaining were very sick, and they were evacuated to Labuan by air for hospitalisation.

South-West Pacific Area headquarters was responsible for recovering prisoners from northern Indo-China, China, Manchuria and Japan and for concentrating them at Manila. Here the 3rd Australian Prisoner of War Reception Group under Brigadier H. Wrigley had established a camp for the British. The camp was well run but many of the recovered prisoners were understandably restless because there was a long delay, sometimes as much as four weeks, in finding transport to take them home. In September Kiel had visited Manila, and he arranged for the airlift to Morotai of approximately 50 sick Australians for whom accommodation was not available in hospital ships.

Admiral Mountbatten's South-East Asia Command was responsible for recovering prisoners from Malaya, the western part of the Netherlands East Indies, from Thailand and the southern half of French Indo-China, and for concentrating them at Singapore. A major evacuation problem facing S.E.A.C. was the airlift of 4,670 Australian prisoners from Bangkok to Singapore, where they were to be embarked on ships for Australia by 23rd September. Only about 100 of the men were hospitalised but as it was a six hours' flight over ocean and the majority of them had not flown before, the A.D.M.S. considered that medical air evacuation escorts would be required on all aircraft, and it was agreed that the organisation and administration of the move would be according to the accepted principles of R.A.A.F. air evacuation.

It was at first intended that Australian prisoners in Singapore who required hospitalisation would be sent by air to the 2/4th and 2/6th A.G.H's and the 2/1st C.C.S. at Labuan. This became unnecessary when British and Australian hospitals were established in Singapore. The 2/14th A.G.H. arrived in Singapore on 13th September, together with the 2nd Australian P.W. Reception Group under Brigadier J. E. Lloyd. Australian Dakotas allocated for the Singapore-Labuan service then became available for the Bangkok airlift, and Australia was also able to contribute four ambulance aircraft and medical air evacuation escorts to the S.E.A.C. undertaking.

Sumatra: Just as the Bangkok evacuation had got under way it was learned from Australian newspaper correspondents that there were large numbers of Allied prisoners, including Australian army nurses, in camps in Sumatra, and that they were in a very bad condition. The R.A.F. had no aircraft to bring them out, and it was decided that the R.A.A.F.

should divert to their rescue aircraft then employed on the Bangkok undertaking. This was not a difficult decision because, although the prisoners in Bangkok had suffered severely during the building of the Burma-Thailand railway, they were well treated after the Japanese capitulation. There was ample food in the country, and it was given to them freely, some of the prisoners putting on two stone in as many weeks; about 100 of them who were sick were in good hospitals.

The first relief plane for Sumatra left Singapore and landed at Palembang on 15th September. The relief party included Squadron Leader F. W. Madsen, the pilot, Major H. M. J. Windsor, A.A.M.C., Sister B. O. Chandler, R.A.A.F. Nursing Service, and Hayden Leonard of the Australian Broadcasting Commission. Their primary objective was to rescue the Australian nurses, but when they came down they found numbers of Allied prisoners who were in such poor condition that they decided to send some of them back in the aircraft immediately. Those of the relief party who remained began a search for the nurses. The Japanese either could not or would not give any information as to their whereabouts, so they questioned everyone in Palembang who was known to have been in contact with them since their imprisonment. The only person able to provide a clue was the Mother Superior of a hospital. She told them that in the previous year there had been Australian nurses at Lubuklinggau, some 150 miles south-west of Palembang. The rescue party flew to Lahat, which was connected with Lubuklinggau by rail, and persuaded the Japanese to send a train. On this the rescuers travelled to Lubuklinggau, where they found 24 Australian nurses and about 600 British, Australian, Dutch and Eurasian civilians. The nurses with 30 other internees were brought to Lahat by train. Matron Sage and Sister Floyd flew in to welcome them, and in the words of Major Windsor, they "staged an almighty reunion". The nurses were then sent to Singapore by air.

To take care of the internees still at Palembang and Lubuklinggau supplies of all kinds were flown in, and hospitals were set up where they might await evacuation. At Palembang the Japanese converted a large building for the purpose, and at Lahat a hospital was established in the Dutch Convent for the internees from Lubuklinggau.

Meantime, aircrews who had visited Paken Baru reported that conditions in camps there were even more appalling than at Palembang and Lubuklinggau, and it was decided to concentrate rescue efforts on those camps. To allow the maximum number of sorties during the day an "all in" effort was made to service, load and fuel the aircraft during the night, R.A.F. aircrew whose fighter aircraft had been grounded to conserve fuel taking over the job of loading the R.A.A.F. aircraft. Thus, as many as 20 aircraft could be sent daily. Three sorties for each aircraft were planned for the 16th, but on that day R.A.P.W.I. announced that no more prisoners could be accommodated in Singapore, and that sorties were to be cancelled for the rest of the day. As prisoners were dying at the rate of seven each day in the camps any delay in bringing them out was unthinkable, and Brigadier Lloyd of the Australian Reception Group,

accompanied by Wing Commander Game, approached Lieut-General Sir Philip Christison, the army commander in Singapore, to suggest that empty houses and hotels should be taken over to accommodate the prisoners. The general agreed and requested his D.D.M.S. to provide 250 emergency beds for the next day, and to make every effort to provide a greater number for the day after. Over 400 men were lifted on the 17th. From then on the daily rate gradually declined but small movements from Sumatra continued until 4th October. The total number evacuated by the R.A.A.F. was 2,289.

Java: It was known that there were Australian prisoners in Java and to obtain first-hand information of their numbers and condition Brigadier Lloyd flew to Batavia on 22nd September accompanied by Wing Commander Game and an R.A.A.F. sister. They found that Major C. W. Maisey, R.A.M.C., a former prisoner, was trying to manage the medical side of the relief, but was hampered by a desperate shortage of suitable food, medical supplies and staff. He told the brigadier that there were about 25,000 Allied prisoners in Batavia and another 24,000 at Semarang and Magelang in Central Java. All the British prisoners, about 1,500, including 339 Australians, were believed to be in Batavia. Arrangements for their rescue were complicated by a number of factors. The Indonesian republican movement under Soekarno had got under way, and many of the male population were carrying weapons; although their hostility was directed against the Dutch, there was always the possibility that the situation would get out of hand. Food was scarce; there was plenty in the country, but the Indonesians would not make it available, and they had driven beyond reach many thousand head of cattle which would have eased the shortage. Medical supplies were also scarce, especially emetine, liver extracts, nicotinic acid, and other vitamin preparations; while aircraft to Batavia could be loaded with these items, the space was limited, as fuel had to be carried in drums for the return journey. The monsoon was due to break within the month, and this would make the prisoners' camps, especially those in the middle of Java, uninhabitable. The water-supply was unreliable and, with the rains dysentery would be a danger. The Dutch were disorganised and could offer little help.

Brigadier Lloyd and his party visited many of the places in and around Batavia where Australians were awaiting evacuation. They found four Australians at the Dutch Hospital, four at the Carolus Hospital, and five medical orderlies at the Mater Dolorosa Hospital, where they were working, but most were in the Bicycle Camp, still confined under Japanese guards because of the political situation. About 185 Australians were there; 180 of them were in a reasonable physical condition, though many of their number would require hospital treatment after rescue; five were in hospital, but all were considered suitable for air evacuation. The Australians were not happy because of what seemed to them a lack of enthusiasm to get them out, although quite a number of their fellows had been evacuated to Balikpapan during the preceding few days in R.A.A.F.

Mitchells and Dutch aircraft, and it had been arranged that more would go the next day.

On the 23rd Brigadier Lloyd and his party left with fourteen sick prisoners, including the four Australians from the Dutch Hospital, who were suffering from tuberculosis, and three from the Bicycle Camp. The British had considered the tubercular patients too sick to move, but Wing Commander Game, believing their repatriation advisable, accepted the medical responsibility for their removal. Within the next few days the R.A.A.F. moved about 317 prisoners, including 152 Australians.

Brigadier Lloyd asked that a contact team be sent to Surabaya to check if any Australians were there, and on 1st October an aircraft left carrying three army men, Senior Sister A. M. Budd of the R.A.A.F., and Wing Commander Game as medical officer. Wing Commander G. H. Purvis was captain of the aircraft. They landed first at Batavia, where they were told that there were no Australians in Surabaya but that eight were believed to be in Bali. However, they decided to check personally, and landed at Surabaya. They were met by the Japanese, who drove them to the Hotel Oranje under a heavy escort. The free Indonesian flag was prominently displayed in the streets, and truckloads of Indonesian youths armed with bamboos with metal blades drove up and down outside the hotel. They then learned that there were five persons to be evacuated, an Australian woman and child, a Dutch woman, and two men, one from the R.A.N. and the other from the R.N.Z.N. The rescue party left early next morning for Bali with an R.N.N. lieut-commander as interpreter, intending to collect the prisoners from Surabaya on the return journey on the same day.

The aircraft reached Bali about 10 a.m. The Japanese commander, summoned to the airfield through the interpreter, said that the prisoners were 60 miles away. The rescuers went to the Hotel Bali in Den Pasar, the capital, to wait until they were brought in. On their way they visited the hospital, and found two Australians who were well enough to be taken along. The other prisoners, all captured in Timor, arrived in the early afternoon. It was decided that all should stay at Bali that night. The Australians felt some apprehension when the Japanese commander announced after dinner that he had been ordered not to fire if there was an uprising. Wing Commander Purvis made him responsible for the safety of the party, but the Japanese had only six men, the rest being up country; four were sent to guard the aircraft, and two remained at the hotel. The night passed uneventfully, fortunately as it happened, for it was discovered next day that the Japanese had no ammunition in their rifles. At dawn the party left with the recovered prisoners.

Flying low over Surabaya, they observed native mobs in the streets and about 2,000 with bamboos on the airfield. There was no sign of Japanese guards, and Wing Commander Purvis decided it was unsafe to land. Even had they done so, they could not have got their intended passengers from the town to the field. They landed at Batavia, and informed the British G.O.C. about the situation in Surabaya. They then

took aboard the remaining British prisoners from Batavia and returned to Singapore.

Rescue operations in Sumatra and Java did not absorb all the R.A.A.F. aircraft contributed to the S.E.A.C. undertaking, and some were sent each day to Bangkok to return the following day with recovered prisoners. Large numbers were moved during the week 21st to 28th September when R.A.A.F. aircraft availability in Singapore was unusually good, and the daily numbers again rose sharply from 1st October because the Sumatra-Java commitment was then almost complete. In all, R.A.A.F. aircraft carried 4,227 from Thailand to Singapore. The rest were moved in R.A.F. aircraft. These figures included a relatively small number of Australians who had been moved from Saigon in French Indo-China to Bangkok by the R.A.F.

The total number of recovered prisoners of all nationalities which passed through the hands of the R.A.A.F. M.A.E.T.U. detachment at Singapore was 7,801. The bulk of the work was completed by 9th October when most of the aircraft and the M.A.E.T.U. detachment returned to Morotai.

Meanwhile, on Morotai the other part of No. 2 M.A.E.T.U. had been working to capacity. As mentioned, over 1,000 patients had been evacuated to Australia during September. This work had progressed smoothly from the middle of the month when R.A.A.F. Liberators and other converted transport aircraft came under the control of the local T. & M.O. On 10th October Advanced Land Headquarters had approximately the following back-log of evacuations: Balikpapan 90, including 8 sick recovered prisoners; Labuan 200, including 140 sick recovered prisoners; Manila 40 sick recovered prisoners and Morotai for evacuation to Australia 200. With the assistance of No. 2 Air Ambulance Unit and special aircraft allotted by the A.T.C. Post, Morotai, these movements were all carried out by the middle of November. With the return of No. 2 M.A.E.T.U. to Australia, some little time later the R.A.A.F's medical air evacuation task in the South-East Asia and South-West Pacific theatres was complete.

CHAPTER 30

MEDICAL ASPECTS OF SURVIVAL

WHEN an airman baled-out or made a forced descent away from his base, especially in enemy territory, his chance of making a safe return largely depended on the preservation of his health and strength. This involved adequate provision of food and water, avoidance of injury, and protection from environmental influences and disease. These factors, which were weighted according to whether the emergency occurred over land or sea, and whether the descent was by parachute, crash landing or ditching, will be discussed from the aspect of conditions pertaining in the South-West Pacific Area.

Because the personal equipment available to the survivor was that worn or carried during flight, and because his actions depended largely on his experience, training and briefing, it followed that survival and escape were to a considerable extent determined by proper pre-flight preparation.

When baling-out, injury might occur in the course of separation from the aircraft, during descent, or on alighting. Baling-out might in fact be prevented or precluded by injury of the aircrew concerned by enemy action, by jamming of cockpit canopies or escape hatches, or by the low altitude of the aircraft at the time of the emergency. Further, centripetal forces generated in an uncontrollable spin or spiral dive might prevent escape of the crew members: if these forces were of such an order as to increase effective body mass by some 2½ times, that is if 2½ positive G units were applied, escape from the average fighter cockpit became a physical impossibility.[1]

The decision to bale-out, which was, at least in theory, always taken by the captain of the aircraft, was influenced by the set of circumstances prevailing. The nature of the emergency itself was often the over-riding determinant, but in general a forced or precautionary landing was always attempted if this was reasonably possible. There was predisposition to making a forced landing rather than abandoning the aircraft by parachute when sick or wounded men were being carried, where availability of the aircraft itself and its fixed equipment might assist survival—as in the jungle or desert—or when flying out of reach of land in aircraft other than single-seaters. In this last case ditching afforded the best chance of survival, by allowing collection of emergency equipment stowed about the aircraft, and enabling members of the crew to remain together in their dinghy or dinghies.

Escape by parachute was in general usually attempted in the following circumstances: complete loss of control, as from mid-air collision, or structural failure; when faced with inability of the aircraft to continue flying, as from motor failure or fuel exhaustion, over very unfavorable terrain or

[1] G. M. Hass, "Unsuccessful Use of Parachutes", *Air Surgeon's Bulletin*, No. 1 (1944), pp. 6-7.

in conditions of limited visibility such as darkness, fog or cloud suspected to reach down to ground level; when over water in an untenable fighter-type aircraft, which type usually sank very quickly on ditching; and in the event of uncontrollable in-flight fire or contamination of the cockpit or cabin by noxious fumes.

Injury incurred during separation from the aircraft was almost invariably due to the parachutist forcibly striking the empennage. In some fatal cases death was virtually instantaneous. In others unconsciousness resulted, and while there are cases on record of consciousness returning in time for the ripcord to be pulled before reaching the ground, there must have been many in which the fatal outcome was due to non-recovery of consciousness during descent. Injury of limbs, of course, could embarrass the parachutist in deploying his parachute, in subsequently controlling his descent, and in alighting.

Due to their airframe configuration some aircraft were more hazardous in this regard than others; especially hazardous were machines of twin tail-boom design such as the American Lockheed Lightning. While use of recommended bale-out techniques, such as "diving" downwards where possible and leaving the aircraft from the side towards the inside of a spin, minimised the risk of striking the airframe, the hazard was increased by certain attitudes and motions of the aircraft and by high forward speed. Blast effect, with flailing of limbs resulting in joint dislocations, was an attendant hazard of bale-out at high speeds.

While bale-out at low altitude presented no hazard peculiar to it except that resulting from the physical proximity of the earth, high-altitude parachuting had associated with it special physiological and operational problems. The former comprised effects of oxygen-lack, of severe cold, and of parachute-opening shock should the parachute be deployed too soon after separation from the aircraft—a problem associated also with high-speed bale-out. The operational problem was to avoid presenting an easy target for enemy fire from the air or ground during a relatively slow and prolonged parachute descent. To both physiological and operational problems the technique of free-fall, or delayed parachute deployment, was in a large measure the answer.

The force of gravity, if unresisted, will produce in any body a constant acceleration of 32 feet per second. If the body is falling through the atmosphere, a retarding force provided by air resistance opposes the force of gravity; since the former increases as the square of the speed of falling, a condition is soon reached in which the forces of air resistance and gravity are in equilibrium, and the body attains a constant vertical speed. The resistance provided by the air naturally varies with its density, and thus the terminal (or equilibrium) velocity is related inversely to air density and hence directly to altitude. Whereas the terminal velocity of an average man wearing an unopened parachute is some 260 feet per second (or 175 miles per hour) at 30,000 feet above sea-level, it decreases to 220 feet per second at 20,000 feet, 185 feet per second at 10,000 feet and 160 feet per second (or 110 miles per hour) near sea-level. These

are average figures for "straight fall". The speed of descent of a man tumbling (rotating end over end) or in the slightly head-down horizontal orientation which the unconscious human body tends to assume during free-fall, is less than in the "straight fall" condition. It should be noted that these same terminal velocities will be achieved irrespective of the speed or direction of flight of the aircraft at the time of bale-out.

Deployment of the parachute reduces terminal velocities merely by increasing the retarding force of air resistance to the passage of the parachute-man complex, thus achieving equilibria at much lower vertical speeds. These will be, of course, subject to altitude variation in the same way as free-fall terminal velocities. For a standard R.A.A.F. 24-foot canopy-diameter general-purpose parachute supporting a "standard" (70 kilogram) man with usual equipment, these terminal velocities will approximate: at 30,000 feet, 44 feet per second (or 30 miles per hour), and near sea-level 26 feet per second (or 18 miles per hour).

The problem of oxygen-lack while descending to "oxygen altitude" after abandoning an aircraft at a greater altitude has already been mentioned. A "standard" man, jumping from an aircraft in level flight at 30,000 feet and allowing himself to free-fall, will reach "oxygen altitude" of 15,000 feet in approximately 115 seconds; on the other hand, should he deploy his parachute as soon as he is clear of the aircraft, his descent to 15,000 feet will occupy some 6½ minutes. At 25,000 feet it takes approximately 90 seconds for a man breathing normally to become sufficiently hypoxic to have difficulty in pulling the ripcord. It will be seen, therefore, that if free-fall technique was employed the degree of hypoxia liable to occur in descent was small, even in a jump made from 30,000 feet—a height greater than those from which the large majority of "high altitude" bale-outs during the Second World War were made. It will be appreciated, however, that if a parachute descent was made from this altitude, it would, in theory at least, result in a moderately severe grade of hypoxia. Thus aircrew were given definite instructions that if forced to bale-out at "high" altitude, several deep breaths of 100 per cent oxygen should be taken if possible before leaving the aircraft, and the breath should then be held as long as possible while free-falling; after counting up to a number appropriate to the altitude of separation—50, for separation at 20,000 feet—the rip-cord should be pulled.

In the event, however, hypoxic effects were seen to be more academic than real. In decompression chamber simulations of free-fall from 30,000 feet, only 1 of 15 subjects showed an arterial oxygen saturation value of less than 75 per cent, while of 12 subjects who were subjected to simulated parachute descent from the same altitude, only one lost consciousness. In actual operations, hypoxia during descent from "high" altitudes appeared to be an insignificant factor in causation of bale-out morbidity and mortality, although the free-fall doctrine received more attention in the breach than in the observance. The fear in aircrew of "passing out" from oxygen-lack was, however, probably not an insigni-

ficant factor in inducing premature deployment of parachutes, with its more serious consequences.

The effect of severe cold during descent has already been briefly referred to as one of the physiological problems of high-altitude bale-out. Exposure of limited body areas to local cold may produce abnormalities which vary from minor functional disturbances to actual gangrene. These various degrees of injury may result whether or not the tissues freeze. This emphasises that the attained tissue temperature is not all-important, but rather the product of temperature and exposure time. This observation classifies the cold stimulus with other physical and chemical agents, the effects of which are represented by the intensity-time curve so well known in physiology and toxicology. From a pathological point of view frost-bite, "trench foot" and "immersion foot" seem the same. The specific terms merely describe the physical conditions under which the injuries are incurred, and hence the term "local cold injury" is better used to encompass all these conditions.

From a few thousand feet above the earth, upwards to 35,000 feet, the progressive drop in atmospheric temperature remains virtually constant at about 2°C. per thousand feet, the temperatures at 15,000, 20,000 and 30,000 feet being of the order of minus 15, minus 25 and minus 45°C. respectively. Referring to the descent times from 30,000 to 15,000 feet quoted in the foregoing discussion of bale-out hypoxia (115 seconds in free-fall, 6½ minutes in parachute descent), it will be appreciated that while the intensity-time product for cold applied to exposed skin areas in free-fall is unlikely to produce any effect beyond superficial chilling, that for parachute descent will almost certainly result in severe local cold injury, especially to exposed extremities.

Failure to wear gloves at altitude, loss of the helmet or dislodgment of the oxygen mask during separation from the aircraft, or loss of a glove or boot due to opening shock of a parachute prematurely deployed at "high" altitude, might lead to cold injury. Cases did occur in the South-West Pacific Area, but the incidence was lower than in the European theatre because of the generally lower altitude of operations. Wearing of gloves at altitude and proper fastening of helmets, masks and boots, combined with the employment of free-fall technique in "high-altitude" bale-out comprised the obvious answer to this problem.

Unacceptably high parachute opening shock resulting from premature deployment of the parachute after bale-out from aircraft at high altitude and/or high speed, already referred to in several contexts, posed a far more serious bale-out problem than either hypoxia or cold injury. The problem was a dual one of generation of decelerative forces producing structural overload in both parachute and man.

General purpose parachutes, as used by the R.A.A.F. in the Second World War, were designed so that, at safe terminal velocities of free-fall, the deceleration imposed by deployment was of the order of 5 to 8 G, acting for a relatively short period. This order of deceleration was achieved in normal deployment at free-fall terminal velocities obtaining at some

10,000 to 12,000 feet, and was harmless to a fit man with properly adjusted parachute harness, and well within the design parameters of the parachute. Conversely, excessive deceleration loads would fracture bones, dislocate joints, injure soft tissues and perhaps cause unconsciousness, and would result in failure of the parachute canopy with ripping of one or more panels, producing canopy collapse or at best a rate of descent greatly in excess of normal.[2]

The R.A.A.F. 24-foot diameter general-purpose parachute, if released at high speeds, tended to remain in the "squid" condition until speed had dropped to some 180 miles per hour, at which point it would flick open suddenly, causing high decelerative loads. Since the rate of parachute deployment (and hence of the onset of G), is proportional to the true airspeed rather than the indicated airspeed, a secondary factor of high peak G was introduced by opening at high speeds. Thus, while reference to descent rates already quoted will show that parachute opening from terminal velocity at 30,000 feet decelerated the man-parachute complex from about 175 to about 30 miles per hour whereas opening from terminal velocity at 10,000 feet produced deceleration from about 115 to about 22 miles per hour, it must be appreciated that in addition to the former overall deceleration being about 1½ times the latter, the rate of its onset was considerably higher due to more rapid deployment. Peak G in the region of 20 thus resulted from deployment from terminal velocity at 30,000 feet. This was very doubtfully within the strength limits of a parachute in good condition, and certainly well in excess of the parachutist's tolerance. The even more excessive loads generated by parachute release at higher speeds, with "squidding" and sudden full deployment, will be appreciated.

One of the most difficult tasks in aviation medical instruction in the R.A.A.F. in the Second World War was to so convince aircrew of the efficacy of free-fall technique in "high-altitude" bale-out that they would put this into practice in such an emergency. The time taken to decelerate to terminal velocity after separation from an aircraft moving at high speed is unexpectedly long; for example, at 5,000 feet, from an aircraft travelling at only 250 miles per hour, 12 seconds or more are required.

That the risk from enemy strafing could be countered by maintaining free-fall for as long as possible has already been noted. An example of the success of this technique is given in an escape report on officers who:

> made a delayed jump, opening their chutes from 1,500 feet to just above the ground. By so doing they escaped the strafing attacks made by the "Nips", which were made on almost all other members of the crew while in their chutes.[3]

Parachute landing traumatism accounted for a large percentage of parachuting morbidity. Perusal of the quite numerous analyses of Second World War emergency parachute descent results indicates that of non-fatal

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[2] G. A. Hallenbeck, K. E. Penrod, R. MacCardle, "Magnitude and Duration of Parachute Opening Shock" in *Air Surgeon's Bulletin*, No. 2 (1945), pp. 35-37.

[3] This and other examples are taken from Allied Air Forces Escape and Evasion Reports, Nos. 44, 47, 49, 50, 60, 61, 66, 68, 69, 70.

injuries sustained, some 90 per cent were incurred on landing. Figures for non-emergency descents by trainee paratroops under "ideal" conditions at the R.A.F. Parachute Training School, Ringway, show that of 280,000 descents there were 1,185 injuries necessitating hospitalisation, 388 (or approximately one-third) being fractures, and 145 (or approximately one-eighth) being head injuries with concussion: approximately two-thirds of the fractures involved the lower extremities. Although the incidence of landing injuries in paratroop work was very much lower than that sustained in emergency descents in the air forces, the patterns of injury appear to have been rather similar in the two categories. This is somewhat surprising in view of the parachutist's inability, in the majority of air force cases, to select, or have selected for him, the landing terrain.

Considered by type, almost all parachute landing injuries were sprains and strains of connective tissues, contusions and wounds, fractures or cerebral concussion; considered by anatomical location, in order of frequency, they comprised injuries to the lower extremities, to the head and face, to the spine and pelvis and to the upper extremities, with miscellaneous injuries to the trunk and viscera as a fifth group. Unfortunately no comprehensive statistics of R.A.A.F. parachute descents during 1939-45 are available, but there is litttle doubt that R.A.A.F. experience (making due allowance for the high percentage of over-water operations in the South-West Pacific Area) paralleled fairly closely that of other Allied air forces.

To appreciate the mechanisms of production of landing injuries, some understanding of certain aerodynamic characteristics of parachutes, especially in the pre-alighting phase, is necessary. Pendulum movement, or oscillation, of the man-parachute complex frequently occurs; commencing at the time of deployment, it is due to cyclic air spillage at the canopy periphery. The condition tends to be self-cancelling due to the action of the central vent in the canopy, the purpose of which is to minimise peripheral spillage. Oscillation may, however, be violent and of large amplitude in its early stages, and extreme instances are thought to have been the cause of death by breaking the neck by "whiplash" effect. At low altitudes the condition, if severe, is invariably a dangerous one as the parachutist may be dashed laterally against an obstacle or the ground, or may strike the ground with unacceptably high vertical speed compounded of the vertical component of the pendulum movement and the descent speed. Aircrew were taught the remedial action—that of pulling down strongly on the suspension webs (or risers) or on the rigging (or shroud) lines, which partially collapsed the canopy but tended to break the cycle of peripheral air spillage; when the pendulum movement was damped the risers or shrouds were to be evenly let up and released. As this manouvre accelerated descent, it could be used with advantage at higher altitudes to minimise time of exposure to cold, hypoxia or enemy action, but near the ground it obviously had its limitations.

The manoeuvre of side-slipping could be used in an attempt to guide the descent away from hazards. It was performed by pulling down firmly

on the riser or shrouds to the side towards which it was desired to slip, thus tilting the canopy and spilling air to the opposite side. This produced lateral deviation, but re-started oscillation which then had to be dealt with. For this reason, and because side-slipping itself increased descent speed, use of the manoeuvre close to the ground was confined to suddenly-recognised emergencies. Turning, to face the direction of drift, could be achieved by the parachutist as he neared the ground. This was important in strong wind conditions, as it allowed him the better to observe obstructions in his path, and to obviate the risk of head and back injury as a result of being dragged backwards on alighting by the unreleased parachute. The technique of turning again involved manipulation of the risers or shroud lines.

In normal parachute descent at altitudes above 5,000 feet, little sensation of descent is present. As descent proceeds below this level, however, details on the ground become more and more apparent, and the horizon is perceived as rapidly spreading out; below 500 feet the earth is felt to be rushing up. In this dynamic perceptual situation it is difficult to assess the distance from the ground by looking directly downwards at any fixed point, and aircrew were therefore instructed to look, in general, at an angle of 45 degrees, glancing periodically at the horizon and directly downwards. The greater difficulty of judging height correctly above water, especially if this was calm, led to the instruction to aircrew to release themselves from the parachute harness only on contact with the surface, even though this carried some risk of entanglement with the shroud lines when in the water. The harness quick-release box was, however, to be turned to the "unlock" position when nearing the water, so that only a sharp blow with the flat of the hand or clenched fist was then necessary to shed the harness. Failure to observe this procedure was responsible for the reported loss of aircrew, who, having baled-out successfully, were seen to release their parachute harness when about 50 feet or more above the water.

It has been stated earlier that the terminal velocity of a "standard" man descending by means of a standard 24-foot parachute, near sea-level, is approximately 26 feet per second, or 18 miles per hour. Obviously, in practice, vertical and translational speeds on alighting will depend on parachute variables such as permeability, on the weight of the man and his equipment, on prevailing atmospheric conditions such as temperature and wind speed (responsible for the lateral component), and on the altitude above sea-level of the terrain. Taking the hypothetical standard condition as a model, however, the kinetic energy to be dissipated on landing is about equivalent to that developed in jumping off a platform ten feet above the ground. It will be appreciated that such a jump will jar the average individual considerably, and may result in injury to the inexperienced jumper.

To minimise the peak decelerations applied both locally and to the body generally, and to avoid local imposition of structural overloads, thus formed the physiological basis of indoctrination in parachute landing.

Every effort was to be made to alight facing down wind, or, in the event of oscillation, in the direction of the swing. The risers were to be gripped firmly as the ground was approached, the feet placed together and the knees slightly flexed. The voluntary muscular tone was to be one neither of complete relaxation nor of undue rigidity. Just before impact the feet were to be placed slightly out of the line of drift so that, after making contact with the balls of the feet, a forward roll to one side could be executed, thus dissipating kinetic energy in the smoothest possible way through the longest possible path. Aircrew were warned to resist the instinctive reaction to "reach for the ground" by extending the legs before impact.

Sometimes minimisation of accelerations was accomplished accidentally by the snagging of the parachute in a tree, leaving the wearer suspended off the ground. Aircrew were warned against releasing themselves from the harness under these conditions until they had made a careful assessment of their distance from the ground; it was impressed on them that readjustment of distance judgment after descent from altitude might take quite an appreciable time, and that in any case judgment in semi-darkness was likely to be faulty. Nevertheless a significant number of cases of minor and severe injury due to inadequately considered release from the harness in such situations did occur. It was recommended to aircrew that if alighting in a tree appeared inevitable, protection of the chest and face should be afforded by folding the arms across the chest and placing the hands before the face, while at the same time, for obvious reasons, keeping the legs firmly together. Later doctrine laid down, however, that the forearms should be held across the face, allowing downward vision underneath them.

The mechanisms of landing injury, then, excluding random trauma from striking obstacles, conformed to a broad pattern. Landing on one foot, or with feet flat, increased the thrust on foot and ankle, with resulting ligamentous tears and fractures; landing with legs extended raised the deceleration peaks applied throughout the body and could have widespread results; landing with legs apart, especially with extended legs, typically produced twisting injuries of the knee, with torn ligaments and/or menisci; sideways or backwards landing produced lateral injuries of the ankles and spinal and head injuries, the latter especially if the neck was extended on impact; abduction of a shoulder favoured dislocation of that joint; and gluteal landings were liable to produce vertebral injury.

Although it has been said that parachute landing trauma differed little in respect of mechanism and treatment from comparable civilian injuries, Service medical officers did require to appreciate the physical characteristics of parachute descent and landing in order to fully understand and adequately manage these injuries. In all cases of heavy landing, even with minor signs and symptoms, routine X-ray of the spine at least was considered desirable. Under operational conditions in the South-West Pacific Area this was frequently not possible, but at training stations on the Australian mainland the practice found some acceptance.

It remains to discuss the psychological and psychiatric *sequelae* of emergency parachute descent, management of which was to a large degree the responsibility of the medical officer. These varied considerably according to the circumstances and the make-up of the individual concerned, but in general they emerged, to a greater or lesser degree, as one or both of two discrete syndromes. The first, involving the immediate mental state, and having ingredients of excitement and fear, was based on the instinctive urge of self-preservation, with fear of falling sometimes prominent; on the severity of local conditions such as the presence of fire, the extent of damage to the aircraft and the difficulty of separating from it; and on an early analysis of hazards encountered after separation, such as enemy attack during descent, and landing risks in enemy territory, in water or at night. It is believed that, in the average case, the urgent necessity to cope with jungle or sea survival after alighting tended to overshadow the demoralising effect of this immediate mental state.

The second post-descent syndrome encountered was that of continuing mental trauma. Absence of objective signs and symptoms in the early stages did not necessarily indicate that the subject had escaped unscathed. Psychic effects, the yield of introspection, could arise after a latent period of days or even weeks; resumption of flying could make manifest a state of stress or emotional upset. A striking example of such delayed effect was development of aphasia or speech impediment days after the descent; the latter condition, in one R.A.A.F. officer, took many months to clear despite a considerable effort of self-help.

It was considered of first importance that all cases exhibiting emotional shock of whatever degree and from whatever cause should be interviewed as soon as possible by a medical officer. Twenty-four to forty-eight hours of sick-quarters observation, beginning with suitable sedation—a barbiturate or paraldehyde was favoured—was thought desirable, and was the practice where operational exigencies allowed. A night's sound sleep was usually sufficient for those affected to a minor degree. Should sleep be unsatisfactory, or agitation or anxiety continue, sedation would be maintained. Continued insomnia was regarded as an indication of the need for continued observation. Resumption of flying duties was in almost all cases determined by consultation between the medical officer and the commanding officer or the aircrew member's flight commander; early resumption, where feasible, was encouraged in the interest of restoring or reinforcing confidence. If thought desirable, a period of leave was recommended, but preferably not until the normal sleep rhythm had been re-established and the medical officer was satisfied in other respects with the subject's mental condition. In the final analysis, very few permanent or semi-permanent psychiatric disablements could be attributed to emergency parachute descent alone.

In crash landing or ditching, avoidance or minimisation of injury was primarily a matter of holding to acceptable limits the peak deceleration to which the body, in particular the head, was subjected. Human tolerance to decelerative forces depends on the magnitude of the force, the duration

of its action, the rate of change of deceleration, the area distribution of loading applied to the body, and the orientation of the body with relation to the force. The elastic limits of the portion of the body to which the decelerative force is applied also influence the outcome, since only when the distance through which the force acts is in excess of the capacity for elastic "deformity" of the part will structural injury result. The mechanisms of crash and ditching injury are further complicated by the complexity which time-force patterns may assume, especially if progressive disintegration of the aircraft structure occurs.

All these theoretical considerations had a bearing on the practical lines of approach which were made to the problem of limiting the peak decelerations to which crew members were subjected. The first approach to the problem, which sought to minimise the deceleration applied in bringing the aircraft and its contents to rest after touchdown on ground or water, concerned aircraft handling techniques. The aim was to make contact at the lowest attainable ground speed, selecting on land if possible a path free of major obstacles, and, in the case of descent on to water, preventing the aircraft from "duck-diving" by digging its nose or wing into a swell. Crash landing or ditching into wind, combined with use of flap, resulted in the desirable reduction of ground speed at touchdown. Making the approach and landing while at least some engine power was still available gave greater freedom in selection of touchdown direction and site and in control of rate of descent, while the technique of making first contact with the tail of the aircraft, in a nose-high attitude, resulted in less sudden dissipation of forward speed. The much-favoured practice of stalling the aircraft on to the ground or water was questionable insofar as it reduced linear deceleration at the penalty of generating higher vertical decelerations, which tended to produce compression injuries of the spine and lower extremities.

The second line of approach to the problem involved the maintenance of the pre-touchdown position of occupants with relation to the aircraft during the deceleration phase—in other words, the aim was to prevent their becoming ballistic within the confines of the cockpit or cabin. The great majority of crash landings and ditchings in which major disruption of the aircraft structure did not occur could be survived if this aim was achieved.

The linear deceleration (assumed to be uniform) acting in an aircraft coming to rest from 100 miles an hour in 300 feet, was about 1 G. The occupants, if unable to be dislodged within the aircraft, were therefore subjected to the same deceleration of 1 G, which produced no untoward effect. If, however, the body or part of the body of a member of the crew was improperly restrained, and moved 3 feet before being arrested by an unyielding part of the aircraft's structure, it attained a velocity of 14 feet per second in relation to the aircraft. If, as frequently happened when a pilot was secured to his seat by a lap strap but lacked shoulder restraint, "jack-knifing" of his body occurred under deceleration, causing his head to be thrown against the instrument panel, and if the distance

of retardation by compression of the scalp and flying helmet and displacement of skull bone was assumed to be 0.5 inch, the decelerative force on the head was 75 G. This resulted in a fractured skull or cervical spine, or both. Loose articles in the back of the aircraft similarly became ballistic and might cause severe injury.[4]

A third line of approach was based on the principle of increasing the area of body surface to which loadings would be applied as a result of contact with aircraft structures during the decelerative phase, with the object of reducing these loadings to tolerable limits. An example of application of this principle was the padding of structures in the cockpit (particularly the reflector gun-sight in fighter aircraft) in the probable path of the head; this increased the decelerating distance by utilising the energy absorbent property of the padding, thus reducing the decelerative force, and at the same time reducing the pressure of impact by increasing the area of contact. By way of illustration, suppose the effective mass of the head of the pilot considered earlier was 10 pounds. The striking force was then 10 x 75, or 750 pounds weight. If the head struck an unpadded gun-sight the area of the contact was of the order of only 1 square inch, and the pressure on the skull was therefore 750 pounds per square inch. The skull could not withstand this and would be fractured. It was later pointed out that lives could have been saved by cockpit design which eliminated certain resistant structures from the path of the head;[5] it would not have been feasible, from the design aspect, however, to relocate reflector gun-sights.

The provision and proper use of restraining harness was of the utmost importance in minimisation of crash and ditching injury. In some aircraft types, however, design considerations precluded provision of such harness for all crew members, and in these cases the body could be positioned against a spar or bulkhead, or wedged in some other way so that it could not move forward in relation to the aircraft during deceleration. Where applicable, the principle of padding was used, parachute and dinghy packs being employed for this purpose by crew members during descent to a crash landing or ditching. The best position was one that gave the greatest area of contact between body and support and so distributed the load. By lying down facing the rear of the aircraft, with the back to a spar or bulkhead, 40 G could probably have been withstood without injury.[6] Where the head could not be braced against part of the aircraft structure, it was desirable to support it against "whiplash" effect by clasping the hands behind it.

A fair measure of protection against fire, which might occur in flight or in a crash landing, and against burns due to a sudden flash or explosion,

[4] That this is a valid analysis is supported by statistics of 453 consecutive aircraft accidents quoted by H. G. Armstrong, *Principles and Practice of Aviation Medicine* (2nd Edition), which show that in 42.4 per cent of fatalities the injuries were to the head only, and in 81 per cent included the head.

[5] H. de Haven, "Injuries in Light Aircraft Accidents", in *Air Surgeon's Bulletin*, No. 1 (1944), p. 5.

[6] J. C. Gibson, W. K. Stewart and Z. Pekarek, "Prevention of Injury in Aircraft Crashes", Flying Personnel Research Committee, 556, Dec 1943.

was provided by even one layer of cotton or woollen cloth. The wearing of long-sleeved shirts with sleeves rolled down, and long trousers, was therefore a fundamental precaution. As this dress was compulsory for anti-malarial reasons, flying in shorts, though quite common up to the end of 1943, was eventually practised on rare occasions only. Other disadvantages of wearing shorts will be mentioned later.

A flying helmet could afford considerable protection against fire, but the standard R.A.A.F. leather helmet was seldom used when the flyer could avoid it; because of poor design the fit was often bad, and it was uncomfortably hot for low-altitude and medium-altitude flying in tropical and sub-tropical areas. These objections were largely overcome by the introduction, towards the end of the war, of the tropical flying helmet of open-weave cloth. Goggles provided considerable protection from both burns and penetrating injury, but A.F.O. 10/B/30, which ordered the permanent attachment of goggles to helmets, was honoured more in the breach than in the observance.

Most aircrew would not wear gloves all the time, partly because they were too hot and partly because of the reduction in manual dexterity they caused, but it was desirable at least to keep them close handy. The standard R.A.A.F. flying gauntlet, which was of thick tanned leather, was clumsy and too hot, and the silk inner glove alone did not provide efficient fire protection. Standard R.A.A.F. motor transport drivers' gloves, with part of the flare removed to prevent snagging on projecting controls and equipment in the cockpit, and anti-mosquito gloves, were both reported on favourably by aircrew.

Whether on land or sea, survivors could expect to meet physical stress and hardship. Pre-existing good physical condition was an advantage, and this for many could be maintained only by regular exercise, preferably in the form of sport. The experience of survivors in lifeboats and dinghies indicated that mental stamina was of even more importance than physical fitness. This applied also in the jungle, where the will to survive and escape was important first in combating the environment and secondly in evading the enemy or escaping from him if captured. In all kinds of combat emotionally stable men with well-integrated personalities had the better records. The knowledge that others had survived and escaped helped to instil confidence. Confidence was further increased if the man placed in a survival situation had received actual jungle training and therefore knew he had the ability to look after himself.

Living off the bush or jungle required, as a minimum, matches and a stout knife. These, together with basic drugs, emergency rations and a compass were made up into "jungle kits", of which the first standard R.A.A.F. type (R8/50) became available in early 1943. Though far from perfect, this was an immeasurable improvement over no kit at all. Later standard kits, such as the "Kit, Survival Aircrew, Complete" (R8/70), comprising a medical pack and more comprehensive survival pack, both in plastic containers, and a signalling mirror, all in a canvas satchel, were a marked advance over earlier assemblies. It was necessary to compro-

mise between including desirable items on the one hand, and minimising weight and bulk on the other, particularly in view of the limited buoyancy of the Mae West. A rule of paramount importance concerning survival kits was that they should be carried securely attached to the person. Records of survival contain many accounts of airmen who lost their kits with their aircraft.[7]

Dehydrated and compressed emergency rations sufficient for 48 hours were carried in most survival kits, but they were so unappetising that in many cases they were eaten only partly or not at all. If a survivor could make contact with friendly natives he would usually be provided with food, but the jungle itself could offer a remarkable amount if the survivor knew what to look for. Actual demonstration by an experienced instructor in the jungle was by far the most effective way to learn about edible wild plants and fruits, but the various official publications on the subject were helpful too. The following contrasting reports speak for themselves.

> We consider that it would be an excellent idea for all combat crews to view an exhibit of fruits and edible vegetables. We saw some that we might have eaten, but since we were unable to identify them we didn't try to eat them.
>
> It was our good fortune to have been briefed the day before we took off, to recognise water vines, limpong palms and lawyer cane, taro, kau kau, and many other jungle and bush foods. We were able to remember enough to keep ourselves alive for the many days that we were totally without European food.

Except in the Northern Territory, water was not often difficult to find. When water was short, however, the rule was to travel only at night or in the early morning and late afternoon, and to rest in the shade for the remainder of the day. As dysentery and cholera were waterborne, water had to be sterilised before drinking. When it was not possible to light a fire and boil the water—either because of a lack of materials or the fear of detection—the chloride of lime tablets in the jungle kit could be used, or as a last resort, tincture of iodine. It was necessary to check all kits before issuing them, because the water sterilisation tablets in the R.A.A.F. R8/50 kit were so often found to have been reduced to powder.

The .38-inch Smith and Wesson revolver which was standard issue to R.A.A.F. aircrew was repeatedly shown to be of little value in survival situations, and many crews carried Thompson, Owen or Austen sub-machine-guns or American carbines. In the final analysis, the only worthwhile effect of carrying personal firearms was a psychological one.

Suitable clothing was necessary to protect the body from incidental cuts and scratches, which quickly became infected under jungle conditions. Long-sleeved shirts, long trousers, boots and gaiters were entirely satisfactory; some survivors stressed the desirability of gloves as well. The R.A.A.F. standard fleece-lined thigh-length flying boots, although warm and comfortable under normal circumstances, were from the survival aspect unsatisfactory to the point of danger. Cases occurred in which they were lost, probably due to air blast during bale-out, were jerked off by parachute opening shock, or came off and were lost when the survivor

[7] Contents of R8/70 Kit are shown in an appendix to this chapter.

descended into water. In the jungle they quickly became water-logged, the soles tended to break away from the uppers, and the soft leather of the latter gave little ankle support in rough footing.

The heavy R.A.A.F. general service boot—a black version of the Australian Army boot—and the American Army boot were both excellent for jungle wear, but the R.A.A.F. boot in standard form was not suitable for aircraft in which much moving about was required (as in Liberators, Catalinas and Mariners), since the hobnails damaged the aircraft and provided a poor foothold on the metal catwalks. Crews serving in these aircraft met the difficulty by nailing strips of patent rubber sole ("Kromhyd") to their boots, or by the time-honoured expedient of begging satisfactory equipment—in this case army "sneakers" or navy boots with rubber soles —from the Americans. The issue of an "official" version of the makeshift described above improved the situation, but this boot did not stand up long to everyday wear. It was galling for R.A.A.F. aircrew in forward areas to see American equipment and supplies, particularly food, superior to their own in quality and quantity, and to know that that equipment and those supplies had been made in Australia. The American army boot was an outstanding example.

The flying helmet gave useful protection to the head for survival purposes, and this was a further argument for wearing it in the aircraft. In addition, bomber crews were usually advised to carry with them their felt hats, which experience had shown to be the best headgear for the tropics.

Care of the feet was vital, and aircrew were advised to carry a spare pair of socks and to treat blisters as soon as they were detected.

Personal protective measures against malaria, such as sleeping under nets, were rarely possible under survival conditions, but the wearing of standard tropical dress and the use of mosquito repellent gave a high degree of protection. Contraction of malaria was probably the greatest single threat to the chances of a survivor on land, and thus its prevention was of prime importance. Once it had been shown that atebrin had no significant effect on flying efficiency, altitude and G tolerance, and night vision, all aircrew operating over malarious areas were advised to take suppressive doses as a routine measure. It was not enough to provide atebrin in the survival kit with instructions to begin taking it on landing, since on a dosage of 0.1 gramme a day the blood concentration would not reach an effective suppressive level for about three weeks, during which time infection could occur. The concentration could be raised to a satisfactory level in four days by increasing the dose to 0.3 gramme a day, without production of toxic effects.

Dengue was a much less serious problem than malaria, but an attack could easily make the difference between success and failure in survival. Proper clothing and a repellent were the only means of protection.

An attack of scrub typhus would almost certainly be fatal under the conditions of survival, but the proper use of dimethyl phthalate repellent gave excellent protection against infection.

Dysentery could be contracted from infected water or native-prepared food. The only safe rule was to sterilise all water, no matter how clear and sparkling, and to prepare food oneself when it could be done without gravely offending native hospitality. The sufferer from diarrhoea could not, of course, decide whether it was due to bacillary dysentery or to another cause. It was therefore considered that aircrew should be instructed to take the sulphaguanidine tablets in their jungle kits at the first sign of diarrhoea, so that, in the event of the infection being in fact bacillary dysentery, it could be brought under control before much damage was done to the intestinal epithelium.

Cholera became an increasing threat as the area of attack moved westward through the Netherlands East Indies. This was a second reason for water sterilisation. Sulphaguanidine was reported to be a successful therapeutic agent, but the dosage required was so large as to make the amounts carried in even the newest kits of little value. Acriflavine, iodine, or other antiseptics were useful for the inevitable minor abrasions and blisters. Use of sulphanilamide powder for these was considered inadvisable because of the risk of development of a hypersensitivity dermatitis.

Operational aircrew usually received some grounding in first aid from their squadron medical officers, but, apart from this, first-aid knowledge was commonly lacking. It was found that first aid for aircrew should consist of a dogmatic exposition of what must be done for the various probable injuries, and a strong injunction not to do more. Knowing what not to do could have saved unnecessary pain and injury to the engineer in the following account, who had a fractured femur:

> The co-pilot and radio operator administered the last-remaining syrette of morphine to the engineer, and under the supervision of the pilot attempted to set the bone. This caused excruciating pain and after pulling the leg with all their strength in an unsuccessful attempt to position the bone properly it was given up as an impossible job. They then decided to splint the leg with sticks to prevent movement of the bone.

Provision of useful first aid was not assisted by the archaic R.A.A.F. Aircraft First Aid Satchel. In practice most squadron medical officers replaced the bulk of the contents with drugs and equipment of their own choice. The kits with which aircraft of American origin were equipped on delivery were generally satisfactory.

Survival at sea. The hazards of ditching an aircraft in the sea were much reduced if the base could be notified of the location of the ditching. Because aircraft often floated for less than a minute after ditching, however, a standardised procedure for collecting emergency equipment and getting it and personnel out was essential. It was not enough to know the ditching drill—it had to be practised. An American crew, proficient at their ditching drill reported that the plane remained afloat for only 45 seconds, but this was long enough to launch both rafts with all necessary equipment.

In certain theatres of war protection against cold was the main problem of survival at sea. In Arctic waters consciousness was lost after

immersion for ten minutes or less. Ability to withstand cold was the main factor limiting survival in the North Atlantic and the North Sea. The essential procedure of decreasing the conductive heat loss by getting out of the water led to the development of the inflatable rubber dinghy, and later of the ingenious airborne lifeboat. In the South-West Pacific Area, however, though cold was experienced frequently during immersion and in dinghies, it was a discomfort only and not a threat to life. Of the local results of cold, frost-bite was never reported, and "immersion foot" was rare.

Even a good swimmer, wearing full equipment, would not be able to remain afloat long, unassisted—hence the Mae West jacket. This derived its buoyancy partly from kapok and partly from a bladder inflatable by mouth or by a carbon dioxide cylinder. The specific gravity of the average body being about the same as that of sea water, satisfactory floating of the unencumbered survivor could be achieved with the 20-pounds buoyancy provided by the Mae West, but there was obviously a definite limit to the equipment that could be carried on his person. The kapok alone provided only 4 pounds of lift and hence the buoyancy of the uninflated life-jacket was not sufficient to keep an unconscious man's nose and mouth clear of the water. However, together with a certain amount of lift gained from air still trapped in the clothing, it helped a poor swimmer to remain afloat long enough to inflate his jacket. Moreover, it tended to hold the body the right way up. It was necessary that the inflated life-jacket should cause the wearer to float in a stable position on his back and nearly horizontally, with his face out of the water. Thus the system of man and jacket had to possess a self-righting characteristic.[8] The R.A.F. pattern Mae West was superior to the American in this regard.

Thirst was the important problem of sea survival in the South-West Pacific Area. The survival time for a healthy, initially well-hydrated man without water in a warm to hot climate is up to ten days. It seemed prudent, therefore, to take a long drink before take-off, since the body is able to store water for up to four or five hours, after which time the kidneys have eliminated most. However, this useful procedure for fighter and short-range bomber crews was evidently not generally used.

The standard method of carriage of water in aircraft for survival purposes was by means of sealed 20-ounce cans located in the inflatable dinghy pack. Survivors who spent time in rubber dinghies emphasised that in addition filled water-bottles should be carried in spite of any slight discomfort they might cause. It was the rule for sea-survival that water should always be salvaged from the aircraft in preference to food.

It was pointed out that it is possible to ration water too severely. The best chance of rescue was in the first few days after ditching, and it was vital to remain in good physical condition during this time. It was considered that the ration should not be less than 20 ounces per

[8] R. R. Macintosh, E. A. Pask, "Floating Posture of the Unconscious Body", Flying Personnel Research Committee Report 550 (1943).

man per day, taken in divided small doses periodically and saving a little for "last thing" before trying to sleep at night. This ration is rather less than the amount required to maintain normal water balance under good conditions.[9] During the day, without shade and with an air temperature of 85°F., the loss of water as invisible perspiration, at rest, is of the order of 10 ounces per hour, and this is increased if there is visible sweat, which is wasted as far as body cooling is concerned.[1] The rate of sweat loss increases sharply with increasing temperature and does not decrease markedly until dehydration is severe. By contrast, after the first 24 hours without fluid, the urinary loss of water falls to less than 1 ounce an hour. Vomiting due to seasickness increases dehydration. Measures which can reduce the amount of water lost in sweating and by vomiting are thus of immense value. Seasickness could be alleviated to some extent by lying flat and keeping the eyes closed, or alternatively by watching a part of the dinghy rather than the sea or sky. Anti-motion-sickness tablets were used if provided. The sufferer, if he was aware of it, may have derived some cold comfort from the knowledge that seasickness rarely lasted more than 48 hours. Avoidance of unnecessary physical exertion during the heat of the day assisted in minimising fluid loss, and aircrew were so instructed.

It was shown that under specific experimental conditions keeping the body shaded and thus minimising radiant heating would reduce water loss by 36 per cent; promotion of evaporative cooling by wetting the clothing with sea water would produce a reduction of 74 per cent. The two methods combined experimentally reduced water loss by 83 per cent; or, to put the matter another way, they increased the theoretical survival time, insofar as it was influenced by fluid deprivation, by a factor of 2.5. Survival time, in the actual event, was likely to be increased by a factor greater than this, since "self-help" measures could enable the survivor to hold out until rain fell, thus providing supplies of fresh water. Continuous bathing in the sea was not advised, not so much because of the risk of attack from sharks or other fish, but because an undesirable loss of body heat might occur from prolonged immersion even in warm oceans. For the same reason it was advised that wet clothing should be allowed to dry before the fall of air temperature in the later afternoon. Wet clothing is uncomfortable at air temperatures below 80°F., and below 65° undoubtedly shortens survival time by promoting excessive heat loss.[2] In this connection it was important to keep the dinghy properly bailed.

As mentioned, food is less important in tropical survival than water. Carbohydrates and fats are preferable to proteins as food components, because water is required to excrete the end products of protein metabolism, whereas the breakdown of carbohydrates and fats provides metabolically-usable water. For example, if 1,500 calories a day were derived entirely

[9] P. H. Putcher and W. V. Consolazio, "Water Balance of Survivors of Shipwreck in Tropical Waters", *War Medicine,* Vol 5 (1944), pp. 203-6.

[1] A. H. Brown and R. E. Gasselin, "Water Losses of Men on Life Rafts". Interim Report to the Committee on Medical Research concerning Water Metabolism, 4 Dec 1943.

[2] Putcher and Consolazio.

from carbohydrates, the 400 grammes required would produce over 200 grammes of water on complete combustion. The flesh of most fish and sea birds is not unpalatable eaten raw, and if the water intake is adequate, provides a satisfactory food source. In addition, the tissue fluids of fish may provide minor additional quantities of water. Fishing lines, hooks and baits were provided in dinghies, and in the later jungle kits.

Sunburn increased dehydration, besides being painful and incapacitating. Although it had been shown that tanning by deliberate controlled exposure provided some protection against sunburn, it was dangerous to rely on this completely. Sunburn in the tropical survival environment could be prevented with certainty only by keeping sunlight from the skin, by use of awnings or clothing. It was important to appreciate that severe sunburn could occur under a "white sky", and that reflection of sunlight from the water could in some circumstances be a major factor in its causation. In addition, the role of exposure to sea-salt, as from spray, and to wind, in aggravation of sunburn was stressed.

For these reasons aircrew were instructed that by day clothing should not be removed in the dinghy, that face and hands should be covered when possible with material such as handkerchiefs or parachute silk, and that anti-glare spectacles and a hat should be worn if available.

Sunburn creams were of doubtful value: prevention, not cure, was the object.

The major role played by emotional stability and maintenance of morale in successful survival of the individual has already been mentioned. In this connection the establishment by the survivor of a definite routine was of great importance, as this implied acceptance of a measure of self-discipline, kept the mind occupied to a degree and assisted preservation of a sense of time and reality. In the later stages of hostilities, awareness of the increasing efficiency of air-sea rescue facilities, operating under conditions of mounting air superiority, did much to sustain the endurance of aircrew who had, in the vernacular of the Service, "dropped in the drink".

APPENDIX

"MIS X" KITS

This kit was previously identified in the R.A.A.F. Vocabulary of Stores as:

R8/70	Kit, Survival, aircrew, complete comprising:
R8/71	Pack, Medical, in plastic bottle
R8/72	Pack, Survival, in plastic bottle
G6E/271	Mirror, Signalling
R4/189	Satchel, Canvas

The contents of the "Medical Pack" were:

Sulphaguanadine tablets
Atebrin tablets
Sodium chloride tablets
Benzedrine sulphate tablets
Sulphadiazine powder

Adhesive compresses
Iodine swab
Tweezers
Ophthalmic ointment (Acid Boric)
Toothbrush

The "Survival Pack" contained the following:

Chocolate rations
Chewing gum
Bouillon powder
Razor blades
Leader kit
Fish hook kit
Fishing line kit
Sewing kit
Compass
Saw blade
Prophylactics
Sharpening stone
Matches

The plastic containers were intended to serve as water bottles after removal of contents.

CHAPTER 31

THE R.A.A.F. DENTAL SERVICE

IN January 1927 the Minister for Defence approved an Air Board recommendation that a dental clinic should be set up at Point Cook, Victoria, with a full-time dental officer. In June of that year this proposal was put into effect and the Dental Service of the R.A.A.F. was thus established. The dental officer attended to members of the air force stationed at Point Cook, Laverton and headquarters, and also visited Queenscliff at regular intervals to attend to members of the army. An arrangement with the Military Board provided for the care of R.A.A.F. personnel at Richmond, New South Wales, by army dental officers. This reciprocal arrangement held until 1936 when the numbers increased and the dental officer at Point Cook had to devote all his time to air force teeth. In 1937 a second dental officer was appointed in Victoria, and also a full-time officer to Richmond. Two more dental officers were appointed in June 1939, bringing the total number to five. These served stations in Victoria and New South Wales; the station at Pearce in Western Australia was under the care of an army dental officer, and that at Darwin was served by local civilian dentists.

The dental orderly mustering was introduced in 1937. Until then medical orderlies had been allotted for duty with the dental officers. No dental mechanics had been employed, all artificial teeth being made under contract by civil laboratories.

Development of the Dental Service. Until early in the war the Dental Service was administered by the Director of Medical Services (Air) under the Director-General of Medical Services, Australian Military Forces, whose Inspector of Dental Services was available for advice. The first staff officer in the dental service was appointed in March 1940, when the senior dental officer was posted to Air Force Headquarters on the staff of the Director of Medical Services to

(*a*) advise the D.M.S. on the organisation of dental services;
(*b*) make recommendations on dental establishments;
(*c*) make recommendations for promotion, postings and retirements of dental officers;
(*d*) inspect and report on dental units and arrangements.

When the R.A.A.F. Medical Service separated from the army in April 1940, the dental service proceeded to develop along the lines appropriate to an air force. Then followed an extremely active period when the plans set out in the Forecast of Development Program for 1940-42 were prepared and carried out. Dental centres were built; equipment tables defining the scale of issue of dental equipment and supplies were prepared, and contract demands were submitted for initial equipment and maintenance stocks. Recruitment and training of dental staff kept pace with the development of facilities. Unit dental sections were set up, with priority to air-

crew training units; part-time consultants were appointed in each capital city to provide for special cases.

As the number of dental sections increased throughout the Commonwealth, there was more work than could be handled by a single staff officer at R.A.A.F. Headquarters; moreover, decentralisation of authority became necessary on matters to a command level. In September 1941 it was arranged for the S.D.O. of units convenient to area and group headquarters to carry out part-time administrative duties. The advantage was to lie in having the benefit of his advice at headquarters, and also in providing contact between unit dental officers and headquarters. Unfortunately, mainly because the functions of this officer were never clearly defined, the plan did not work out. In November 1942, therefore, provision was made for a dental staff officer at area and group headquarters to be responsible through the P.M.O. for administration and treatment arrangements within the area or group. He was known as the Principal Dental Officer, and his duties included:

(*a*) inspection, at least once in six months, of unit dental sections;
(*b*) coordination of the work of individual dental sections, particularly on the dental treatment of trainees as they passed through the various schools;
(*c*) direction and control of mobile dental sections;
(*d*) submission of reports and recommendations on dental matters;
(*e*) liaison with dental staff officers in the army and navy, and with civil dental organisations.

The P.D.O's were appointed on a geographical basis, and as the largest numbers of dental sections were at training units in the southern States, they were appointed to Training Group headquarters in those States. Deputy P.D.O's were appointed in Adelaide and Brisbane to represent the P.D.O. in that section of the command. The P.D.O. was expected to make frequent visits to the units under his control, and to take whatever action was necessary to improve the efficiency and balance of dental facilities throughout his area.

By the end of 1942 the dental service had grown to 30 times its pre-war size, and it was felt that some improvement in status and recognition within the Medical Branch was desirable. When the Medical Director was gazetted in April 1943 as Director-General of Medical Services, the dental staff officer (M.A.3) was renamed Director of Dental Services. Wing Commander N. H. Andrews became the first director. The administration of the directorate fell into five sections, as follows:

Director of Dental Services:
To advise the D.G.M.S. on dental matters
To organise and administer the Dental Services
To be responsible for policy on dental treatment
To inspect and report on dental sections and arrangements
To control dental personnel and equipment generally
To maintain liaison with other dental services.

D.S.1:
General assistant and deputy to the director
To advise the Director of Personal Services on first appointment of dental officers

To recommend promotions, posting and retirement of dental officers
To recommend establishments of dental personnel
To plan dental centres
To coordinate dental personnel and equipment requirements at units
To supervise dental books and publications.

D.S.2:
To enlist, train and post airmen and airwomen in dental musterings in collaboration with other directorates
To be responsible for the trade testing of dental mechanics and orderlies
To supervise dental records, returns and statistics
To act as administrative officer for the directorate.

D.S.3:
To collaborate with A.M.S.E. Branch on supply and distribution of dental equipment and supplies, establishment and vocabulary of dental stores, and preparation of contract demands for dental stores
To inspect dental stores
To keep in touch with dental supply houses.

D.S.4:
To advise the D.D.S. on professional matters
To keep in touch with developments in dental science and dental treatment methods
To supply dental specialist treatment.

The line of organisation was now complete: the dental service had the support at Air Board of the medical service on major policy matters, while through the P.D.O's at Area and Group headquarters there existed a chain of control from D.D.S. to unit dental officers and mobile dental sections which was comparable with that in the medical services.

Dental manpower. When war broke out there were still only five dental officers in the R.A.A.F., and therefore no reserve to call upon as the Service rapidly expanded. The fact that the air force was not yet in a position to offer service overseas, as the army and navy were, put it at a definite disadvantage. Dentists for the three Services were recruited independently until the formation in May 1942 of the Dental Advisory Sub-Committee within the Central Medical Coordination Committee, which was to ensure that the dentists available were equitably distributed among the three Services and the civilian population. An Honorary Dental Adviser was appointed in each State, and each Service was required to consult these officers before accepting volunteers. The ratio decided on by the Standing Committee of the Service Medical Directors at a meeting on 22nd January 1943, was one dental officer to 900 troops, with provision for making troops dentally fit before embarkation, and also for irregular distribution of troops. Requests for additional dentists for aircrew trainees were sympathetically treated. This policy, which was approved by the Department of Defence, formed the basis on which R.A.A.F. requests for dental officers were based.

In April 1943 the coordination of dental manpower was transferred to the Department of Labour and National Service, and a Central Committee and State sub-committees were set up to advise the Director-General of Manpower on matters affecting dentists. The air force was represented

on the Central Committee by the Director of Dental Services, and on the sub-committees by a principal dental officer or his deputy.

It was decided that recent graduates would be accepted for enlistment but that practising dentists would be accepted only if in the opinion of the relevant State sub-committees they could be released from civil practice. Dentists made available were allotted to the three Services in accordance with quotas decided by the Central Committee, taking into consideration personal preferences for one Service or another.

The proportion of dentists to troops decreased as the Services expanded, until it was reduced to 1 in 1,100. Approval was later given for female dentists to be recruited, and one was actually appointed by the air force; she was, however, the only female dental officer to serve in the Australian Services.[1]

When they were first appointed, dental officers were posted to the large dental centres at Ascot Vale, Victoria, and Bradfield Park, New South Wales, where they were instructed in Service matters and on the application of their dental knowledge to the requirements of Service policy. Lectures were given on Service routine, administration of dental centres, dental treatment policy and priorities, stores and accounting procedures. When this initial training was over, dental officers (particularly those newly graduated) were posted to units in base areas as junior officers under the guidance of more experienced men. Whenever possible they started off in a series of different units—training schools, recruit depots and fixed stations—to get a broad idea of how the dental service functioned. By mixing together officers from different States, a valuable exchange of ideas and techniques was achieved.

A special category, Dental Administrative Officer, was created in the Administrative and Special Duties Branch. These were experienced airmen serving as dental mechanics or orderlies who had been through the officers' training course and were able to take over routine administrative work and release dental officers for professional duties. They were used in the following posts:

in the Directorate of Dental Services, in the posts of D.S.2 and D.S.3 on equipment and personnel duties;
as assistants to P.D.O's at command headquarters;
as administrative assistants to S.D.O's of the largest dental centres, at Ascot Vale and Bradfield Park;
in charge of dental stores at No. 1 Base Medical Store, Albury, which was the master depot for all medical and dental stores.

Dental mechanics. As mentioned, false teeth for members of the air force were made in civilian laboratories before the war; there was no mustering for dental mechanics until July 1940, although a number of mechanics had already enlisted as dental orderlies. To help meet the general shortage of dental mechanics, the R.A.A.F. set up a training school at Laverton in June 1941 where an intensive six months' course was given. The training laboratory was later moved to Ascot Vale.

[1] In 1945 the establishment of dental officers was: 1 group captain, 3 wing commanders, 52 squadron leaders and 160 flight lieutenants.

There were two grades of dental mechanic: the senior mechanic, who was competent in all phases of work in a dental laboratory; and the junior mechanic, who was competent in routine processes but could not handle advanced denture work. Before a trainee could be classed as a senior mechanic—and ranked as an N.C.O.—he was required to pass a further trade test in the advanced phases, including setting up, clasp-forming, casting and backing teeth. Short advanced courses were given about 12 to 18 months after remuster to dental mechanic.

Later a course was held with W.A.A.A.F. trainees, but as the war ended less than twelve months after the course was completed it was not discovered whether the women would ever have managed to qualify as senior mechanics.

Two special courses were arranged for dental mechanics during the war: the first was in 1942 when acrylic resin was introduced as a base material for dentures; senior N.C.O's in charge of laboratories were put through the course so that they could instruct other mechanics in the new techniques. A second course was held in 1944 when the end of the war was in sight. This was a refresher course designed to help rehabilitate dental mechanics, and dealt with types of work that would be required in civil life but that had not been used in the air force, including cast base dentures, crowns and bridges, partial dentures and retainers. There was not time to allow all serving mechanics to take this course, but an attempt was made to see that those who had been longest in the Service got the benefit of it.

In the first place the army allocation of a senior and a junior mechanic to each section was adopted. However, it was necessary to vary this according to the demands of the various units: at recruiting depots, for instance, the denture work was particularly heavy. In forward areas mechanics were provided on the basis of one senior to two M.R.S's, and allocated by the P.D.O. according to working arrangements. Apart from his technical duties the senior dental mechanic was responsible for demanding stores, keeping stores records and regulating the quantity and quality of prosthetic work in the laboratory.

The Dental Sections. On the mainland of Australia R.A.A.F. activities were divided into three sections: operational, supply and maintenance, and training of aircrew and ground staff. All were carried out from fixed stations or camps, each of which had its own dental section, or in the case of small units was served by mobile dental sections. Each section was a complete functional entity, with facilities for all dental treatment, including a laboratory. As the Service was growing rapidly buildings for dental treatment did not always keep pace with the need, especially at E.A.T.S. schools where training had often started before the dental centre was put up, and work had to be done under makeshift conditions.

Each of the R.A.A.F. hospitals was provided with a dental section for treating staff and patients. Where the hospital was part of an air force station, as, for instance, at Ascot Vale and Richmond, the dental sections



(*V. J. Odlum*)

Mobile dental surgery which serviced No. 464 Squadron in England.



(*R.A.A.F.*)

Flight Lieutenant R. F. Deacon of the R.A.A.F. dental service, treating a patient at Torokina, Bougainville, in February 1945.



The outdoor uniform worn by Australian nurses during the 1914-18 War.



(*Australian War Memorial*)

An Australian Army nurse in the outdoor uniform of the 1939-45 War.

were large enough to provide for the station personnel. The R.A.A.F. sections of the large base hospitals at Concord and Heidelberg also carried dental officers and consultants for the treatment of jaw fractures and injuries. Extensive face and jaw wounds were treated, under an inter-Service arrangement, by special army teams in the facio-maxillary and plastic wards.

Mobile dental sections were used for treating small and isolated units. The first of these was a semi-trailer fitted as a dental surgery, which was bought in 1940. Later the mobile sections came in three forms: mobile, transportable and itinerant. The semi-trailer was fully mobile and was used throughout the war in the eastern States and in South Australia. Dental surgeries were built on to several truck chassis, and were fitted with pump chairs, dental units, and X-ray and laboratory equipment. The section could make a brief visit to such small units as radar stations, plug in to the local power supply, and immediately start work.

The second type of mobile section was transportable, and was used by sections which made longer stops. Field equipment was taken in panniers from one unit to another by road or rail and was housed in accommodation provided by the unit. Such sections spent much time waiting for transport and also setting up and later repacking the equipment, but the air force could not afford to have trucks immobilised during the long periods spent at the larger units, and transport could not therefore be provided for the exclusive use of the section.

The third type of mobile section was itinerant: dental equipment was installed at certain units and the dental officers moved from one to another, taking only their own personal effects. In Western Area, where road and rail transport were limited, transportable units were moved by whatever aircraft were available—from Tiger Moths to Douglas transports.

Mobile dental sections were borne on the strength of the appropriate headquarters and were operated under the direct orders of the P.D.O., who controlled their allocation and directed their movements. They proved particularly valuable in treating units which formed on the mainland and moved complete to northern areas and therefore did not pass through the personnel depots where they would normally have been made dentally fit for operational service. In urgent cases two or more mobile sections were put to work on the same unit.

Specialist treatment and advice were often necessary, particularly in the fields of oral surgery and periodontia. This was provided by part-time specialists on the establishment of the appropriate area group headquarters in each of the capital cities. These specialists treated patients either in their rooms or during visits to R.A.A.F. units, usually in R.A.A.F. or combined Services hospitals. Later in the war experienced dental officers with an aptitude for such forms of treatment were appointed as specialist officers at major dental centres in or near capital cities, again usually associated with R.A.A.F. hospitals or larger sick-quarters where theatres and other surgical facilities were available. These officers undertook minor oral surgery and periodontal treatment and advised other dental officers

on diagnosis and treatment. When they were not fully occupied in the special fields they helped in the routine work of the dental section. The part-time specialists were therefore relieved of all but the most extensive and complicated cases.

Local civilian dentists were used early in the war to treat smaller units, and to attend to training schools which were just starting up and had not yet made provision for a dental section. As the dental service developed civilian dentists were used less and less, until finally they served only very small detachments to which it would have been uneconomical to send a mobile dental section, and small units when attention was needed between the visits of a mobile section.

R.A.A.F. Dental Service in operational areas. In forward areas the dental service consisted of mobile sections, a number of which were allotted to each operational command according to the personnel strength.

From 1942, when the operational areas were rapidly developed after the entry of Japan into the war, until late in 1944, each Area, Group or Command headquarters administered all its units direct. At the end of 1944 squadrons and maintenance units were grouped into wings, each with its wing headquarters, as subordinate formations within the command. The organisation of the dental service in operational areas closely followed that of the force generally.

At first dental staff was posted to the command against a block establishment on the Area headquarters and formed into sections, each containing a dental officer, one or two mechanics, and an orderly. They were provided with field dental outfits (panniers), tents and other accommodation stores, moved to the site of operation, and were told which units they were to provide treatment for. In effect each command was divided into a number of "zones", each containing 1,000 men and having its own dental section. Many sections became static, because most units were situated near airfields or strips; others moved about with their units. Dental sections were also borne on medical receiving stations as an integral part. The dental officer could then treat patients of the M.R.S. and any near-by units; he thus became a "zone dental officer". He was provided with instruments and equipment for minor oral surgery and treatment of jaw injuries. Towards the end of 1942, when the wing organisation was developing, mobile dental sections were allocated on a wing basis; two or three were attached to each wing with one dental officer in charge of their functioning. In the final arrangement each wing had on establishment its own dental sections, which moved and operated as part of the wing, their disposition within the wing being arranged by the senior dental officer. The Principal Dental Officer retained control only of sections attached to units directly under the command of headquarters; those of the wings were administered through the wing's senior dental officer.

When the Australian Government supplied Nos. 1, 8 and 21 Squadrons for service in the Far East, to free R.A.F. squadrons for service else-

where, these squadrons, together with a station headquarters unit, were based at Sembawang and Seletar aerodromes on Singapore Island, with an advanced base at Kota Bharu on the Malay Peninsula. At the request of the R.A.F., an R.A.A.F. dental officer was made available in February 1941 and stationed at Sembawang, making occasional visits to Kota Bharu. There was a centralised R.A.F. dental laboratory at Seletar, but the R.A.A.F. dental officer found that having to send denture work at successive stages to the laboratory proved slow and inefficient, and resulted in a low standard of workmanship. He therefore had a dental mechanic and equipment sent from Australia, and his section then became a fully-functioning R.A.A.F. unit.

As the Japanese advanced, the dental section moved to Sumatra, then to Java, and finally back to Australia. During the evacuation the dental staff collaborated with medical officers in the collection, transport and care of casualties.

Aircrew provided for service in the R.A.F. were made dentally fit before they went abroad; after that their dental care was the responsibility of the R.A.F. A dental officer was borne on the staff of Overseas Headquarters, United Kingdom, to act as liaison officer with the R.A.F. and other Services, and to provide treatment for R.A.A.F. personnel in London. During 1942 he reported that the dental health of R.A.A.F. members was deteriorating, particularly among the ground staff of E.A.T.S. squadrons. The R.A.F. was able to supply only one dental officer to 1,500-2,000 men, and it was quite impossible to keep the Australians at the high standard of dental fitness to which they had been brought before embarkation.

A mobile dental unit was therefore provided to visit the squadrons periodically and to maintain a satisfactory state of fitness. A second unit was added later. These were fitted with both a surgery and a laboratory, which was contrary to R.A.F. procedures but in accordance with R.A.A.F. policy. Some tact was necessary to avoid antagonising R.A.F. dental officers and suggesting that the care of the Australians was being taken over entirely. Fortunately the R.A.F. was most cooperative, and the mobile units proved effective in bridging the gap between R.A.F. and R.A.A.F. entitlements.

Australian dental officers in Britain found a high incidence of Vincent's infection and chronic gingivitis among our men, and nearly all needed scaling to remove heavy accumulations of calculus. This was common to nearly all Dominion servicemen in Britain, and was ascribed to four main factors: (*a*) changes in diet and environment; (*b*) a diet needing little mastication and lacking fibrous foods; (*c*) lack of attention to oral hygiene; (*d*) too few R.A.F. dentists to undertake regular scaling of teeth to prevent the aggravation of gingivitis. As a result of these chronic infections, many teeth were lost that could have been preserved with adequate and regular dental care.

When the war in Europe ended, the mobile units were concentrated at the Reception Depot to provide treatment for released prisoners of war. Those prisoners who had made use of the limited dental treatment available in the prisoner-of-war camps were reasonably fit, but the rest were in a very bad state. After the main drafts of R.A.A.F. left Britain, the dental staff was repatriated and demobilised.

The senior dental officer of Overseas Headquarters, through his association with other dental services in Britain, was able to obtain much useful information on the policies and procedures of other forces; he was also able to supply, in his reports, details of new materials and techniques, results of research on clinical subjects, training syllabi, and advances in treatment of war casualties, all of which were of great value in keeping the R.A.A.F. dental service abreast of current developments.

Australian squadrons in the Middle East always had difficulty in obtaining satisfactory dental attention. They were dependent on whatever dental facilities happened to be available at the moment, always knowing that the patient or the dental officer might have to move before any effective work could be done. In 1943 the R.A.F., which was very short of dental officers, decided that Dominion Services would not be given any more treatment than their own forces. A mobile dental section was therefore sent from Australia, to operate in the Middle East in the same way as those in Britain. Field dental equipment in panniers was supplied so that the section could easily be moved from one squadron to another. The section travelled during 1944-45 from Cairo, across North Africa and into Italy. After the German capitulation it was transferred to Britain and took part in the treatment of returned prisoners before they were repatriated.

The standard of dental health of the R.A.A.F. abroad would have been much higher if the R.A.A.F. had undertaken full responsibility for treatment; the ideal arrangement would have been for the Australians to be grouped into wings, each with its own dental section. The R.A.F. did everything possible, in the face of its own great difficulties, but there is no doubt that the inadequacies of dental treatment would have been much reduced if the R.A.A.F. had had its own service.

Dental treatment policy. Before the war recruits were required to be dentally fit before they were accepted; dental treatment was intended simply to maintain dental fitness, and especially to preserve the natural teeth; precious metals and artificial teeth were not provided by the Service. Attention was provided only for permanent, full-time members, and not for civilians at air force establishments or for members of the Citizen Air Force.

When war broke out a change of policy immediately became necessary; reservists and members of the Citizen Air Force who were called up were in need of dental attention, and many recruits were being lost who were otherwise entirely suitable, simply because they could not be accepted

until they had gone to the expense of having their teeth seen to. Therefore the War Cabinet decided that dental treatment might be given after enlistment, and also that members of the permanent force might be given false teeth, if necessary. For the rest of the war, therefore, recruits were accepted without dental examination.

The treatment of recruits presented a major problem. The average recruit had one tooth to be extracted, five to be filled, and often needed false teeth and treatment for pyorrhoea, gingivitis and other conditions. Every 500 recruits represented a full year's work for a dental officer. The problem would have been simplified if recruits had spent the first few months in a large depot in each State, where their dental needs could have been attended to, but the complex training program, by which every recruit passed through one or more training school and attended classes of varying duration, made any such simple arrangement impossible. A scheme was therefore devised which served as a theoretical basis for manning dental sections at training units. It envisaged that half the dental requirements of aircrew trainees would be met at the initial training schools and the other half at the final training schools, and that technical and ground staff would have extractions and urgent treatment at recruiting depots, then half their requirements at technical and signal schools and half at the engineering school. By the time their training was finished recruits would, in theory, be dentally fit for posting to Service units, whether at home or abroad. This did not always work out in practice, particularly in the case of aircrew trainees, who often went abroad after I.T.S. to complete their training in Canada or Rhodesia; they had to have special attention before they embarked. Some ground staff, particularly those in unskilled or semi-skilled trade musterings, went direct from recruit depots, or through one short course, to Service units; their treatment had then to be completed wherever they were serving. It was not possible to hold up trainees passing from one school to another or to Service units, and the dental treatment program had therefore to be adapted to the flow of trainees. However, it did prove itself as a sound basis, and later, when the air training scheme became more stable, the plan was followed almost exactly.

In treating recruits the important points were: to preserve the natural teeth wherever possible; to train the men in oral hygiene by lectures to groups and by individual instruction; to give treatment in the right sequence, dealing first with extractions and then with conservative treatment in order of its urgency. It was stressed that sound professional work should never be sacrificed for speed or for large returns.

After the initial dental treatment was complete, regular attention was important. The air force system was to post men as individuals from one unit to another, and instructions were given that all members were to have their teeth inspected when they arrived at a unit; their treatment needs were then recorded and became part of the planned work of the dental section. The few who were not posted within a year or more were called in for examination.

The sequence was interrupted when Japan entered the war and operational areas in the north and in the islands expanded rapidly. Emphasis was placed on ensuring that those going to forward areas were dentally fit, and with the sudden large influx of recruits the work accumulated; it was not for some time after the expansion of dental facilities that arrears were overcome. Early in 1942, when large numbers of troops were moved north at short notice, the previous standards of fitness had to be waived, and a direction was issued that men were only to be kept back if their dental condition was such that they could not masticate their food or were suffering from contagious gum infections. As a result, northern areas, particularly North-Eastern Area, received large numbers of troops in all stages of dental unfitness, and the greatest difficulty was experienced in bringing them to a reasonable standard before posting them to outlying and isolated units.

The problem was not solved by building up dental staffs at embarkation depots; it was found that the condition of teeth at embarkation depots was deteriorating, and the possibility of supplying adequate treatment was proportionately less. As the depot dental officers could not do more than they were already doing, unit officers were called upon to improve the position. Requests were made for more adequate notice of postings to enable the necessary work on the teeth to be completed. Troops at embarkation depots fell into four dental groups: those who could not be made fit for posting within a month; those whose treatment could be completed within one month but not immediately; those whose treatment could be finished within a few days; and those who were already fit for posting or whose treatment could be completed immediately. The men were examined as soon as notice of postings was received, and the commanding officer was informed. Recommendations for deferring or cancelling a posting because of the state of a man's teeth were made only in serious cases, because the need for forces in operational areas was usually most urgent.

Under a reciprocal agreement between the Services, units of other forces which were not large enough to carry a dental officer were treated by the R.A.A.F. dental officer of the station on or near which they were situated. The Services in question included the Australian Military Forces, the Australian Navy, and the forces of the United States and the Netherlands East Indies.

The dental treatment in any air force unit was part of a coordinated scheme to make every member of the Service dentally fit. A unit consisted of two main groups: (*a*) the unit staff, including aircrew, ground staff and instructors; (*b*) the trainees. It was the function of the senior dental officer of the unit to allot the available working time of his officers to the requirements of the two groups. In order to enable him to fit in dental work without interrupting the training of recruits, close cooperation with commanding officers and instructional staffs was essential, and a copy of the training syllabus was consulted when dental appointments

were made. It was not always easy to persuade commanding officers of the importance of making the men available for treatment.

First priority was always given to flying personnel. For other members there was a system of priorities, by which the necessary treatment was classified according to its urgency. In this way treatment was spread over all personnel according to the need, and the highest possible standard of fitness was achieved with the facilities available.

Oral hygiene and periodontia. It was found necessary to stimulate an interest in oral hygiene by increasing knowledge. Lectures were therefore arranged for all personnel at all units every six months. In addition, each course at a recruit depot, initial training school, W.A.A.A.F depot or other unit where recruits were posted on enlistment, was given similar lectures. Dental officers were provided by the Dental Health Education Department of the Australian Dental Association with material on which to base their lectures, and with instructional films for use with the lectures.

More teeth were lost through periodontal disease than from caries, and the importance of proper care of the gingival tissues was therefore evident. Particular faults on the part of dental officers were:

(*a*) neglect of periodontal conditions;
(*b*) failure to perform thorough scaling or prophylaxis as a preventive or curative measure and to instruct patients in oral hygiene;
(*c*) unnecessary, or even undesirable gingivectomies, without correct treatment and instruction before and after operation;
(*d*) failure to eliminate incubation areas in treating Vincent's infection.

A circular was therefore drawn up setting out standard practical application of oral hygiene and periodontia for servicemen during war. As opinions on details of technique, treatment and toothbrush drill differed throughout the profession, various authorities were consulted and a standard technique was evolved which would give satisfactory results and could be effectively carried out by all dental officers. For the sake of discipline, and so that faith in dental officers would not be destroyed by their differing personal preferences, uniform treatment was insisted on.

The depths of the pockets provided a useful guide to treatment of periodontal conditions. When the pockets were up to 4 millimetres deep complete prophylaxis was performed, with particular attention to subgingival calculus; the patient was instructed in the proper way to massage the gums with his toothbrush and to stimulate the interproximal spaces; gingivectomy was not to be performed unless the treatment was unsuccessful. When the pockets were between 4 and 6 millimetres deep gingivectomy was performed, but only if the patient was psychologically suitable and completely cooperative, because the success of the operation depended largely on the patient's own efforts in caring for his gingival tissues. Care and instruction before and after the operation were essential, and the dental officer who performed the gingivectomy was responsible for the patient until proper tone was restored to the gingival tissues, and haemorrhage on brushing had ceased. When the pockets were over 6

millimetres deep, bone loss had gone beyond a safe margin, and extraction was indicated. Extraction was also indicated in the following cases:

(*a*) very mobile teeth resulting from bone loss;
(*b*) involvement of the bifurcation of the roots;
(*c*) third molars with marked distal flaps which were inaccessible to the toothbrush;
(*d*) doubtful teeth in apathetic patients;
(*e*) teeth that could not be brought into function.

When individual teeth had deep isolated pockets, the general state of the mouth was taken into consideration when deciding on the treatment.

The possibility of Vincent's infection was borne in mind whenever inflammation was present. There were always a few cases and even minor flare-ups, but no outbreak of the condition occurred at any R.A.A.F. establishment. This was thought to be due largely to the improved standard of dental health resulting from the treatment of recruits as soon as they entered the Service. When cases did occur, the cooperation of the medical officer was sought to ensure isolation of the patients, and definite instructions were given for cleaning the mouth and for sterilising eating and drinking utensils.

Facio-maxillary injuries. Early treatment of facial injuries, particularly those involving the bony structure, was of the greatest importance. When such bones as the mandible and the maxillae were affected close understanding and cooperation between medical and dental officers was essential if good results were to be obtained.

As a general rule it was the responsibility of the dental officer to immobilise the fractured fragments in a position of normal occlusion against the opposing jaw; this ensured that the teeth met properly after the fracture had united and that full function was restored. If such immobilisation was not carried out early, gross distortion of the parts occurred rapidly, treatment was unnecessarily prolonged, and the patient experienced a great deal of pain and discomfort while awaiting treatment. In forward areas it was necessary to be able to treat the patient quickly and in such a way that he could be evacuated without delay. This treatment consisted of simply supporting or immobilising the injury, and the choice of treatment depended on the nature of the injury and the general condition of the patient, on the delay before evacuation and the time it would take to get to a facio-maxillary and plastic surgery unit at a base hospital. Frequently, particularly in cases of shock, the ideal method of immobilisation could not be used and a more rapid method was substituted until the patient's condition improved. When there was a delay of perhaps a week in evacuating the patient, and his condition warranted it, splints were constructed in suitable cases. When teeth were present the open-case silver ferrule splint was the method of choice for complete immobilisation. When evacuation was almost immediate, treatment was confined to an elastic chin strap, barrel bandage or simple wiring. However, it was emphasised that patients with facial injuries should always be taken as

soon as possible to a base hospital where the proper facilities were available for treating them.

The barrel bandage was useful as a support for fractures of the mandible and maxillae during evacuation; it was quickly applied and could be made from materials usually at hand. A more effective bandage could be made from calico or another firm material carried round under the lower jaw and over the vertex two or three times, then round the forehead and back of the head. Webbing headgear with hooks in the temporal regions to which a rubber chin bandage could be attached was another useful way of supporting a fractured mandible or maxilla. The four-tailed bandage was condemned: backward pressure could too easily be applied to the mandible, with resulting embarrassment of respiration and increase of displacement.

From many points of view intermaxillary fixation with the teeth in occlusion was more satisfactory than single jaw fixation. It was undesirable when the patient was difficult to feed because of his general condition; or when there was risk of respiratory embarrassment—for example when he had a full set of teeth and the nasal passages were occluded with a blood clot; or where there was oedema of the tongue and soft tissues of the pharynx. In such cases single jaw fixation, or bandage support which did not prevent the mouth opening, or no fixation at all, were indicated until the patient had recovered sufficiently for intermaxillary fixation to be used.

Single jaw fixation, either by interdental wiring or by a single-arch wire attached to several teeth on each side of the fracture, was comparatively inefficient because it allowed movement in the fracture and of the whole lower jaw. It was superseded, or combined with, intermaxillary fixation as soon as conditions permitted.

Early reduction and fixation of fractured maxillae was a complex procedure, and as union occurred very rapidly it was important to evacuate the patient as soon as possible. Support by bandage gave considerable relief during evacuation.

Gunshot wounds of the upper and lower jaws were usually associated with extensive fissure fractures, loss of bone and soft tissue. The greater the bone loss the greater the distortion of the soft tissues and the greater the displacement of the bone fragments. In these cases early immobilisation was carried out, using any existing teeth for fixing the remaining fragments in correct occlusion with the opposing teeth. For instance, where there was bone loss in the symphysis region of the mandible and there were teeth in the remaining fragments, an attempt was made, usually by intermaxillary wiring, to fix the teeth in correct occlusion with the maxillary teeth. This was only done, however, if it did not delay evacuation to a facio-maxillary and plastic surgery unit.

CHAPTER 32

THE R.A.A.F. NURSING SERVICE

UNTIL 1940 R.A.A.F. sick were nursed by male nursing orderlies or by civilian nurses. The latter were engaged for short periods on occasions when emergency surgery was carried out at station sick-quarters. Early in 1940 outbreaks of minor infectious diseases, influenza, rubella and mumps, swept through R.A.A.F. units, and Group Captain Daley arranged for the continuous employment of 16 civilian nurses. Four were allocated to Laverton, 2 to Point Cook, 5 to Ascot Vale and 5 to Richmond. Later their number was increased. With the rapid expansion of the air force in 1940 and later, this was not enough, and it became clear that a nursing service was required within the air force. R.A.A.F. nurses, in addition to benefiting the sick by their high professional standard of attention, could be used for the instruction of nursing orderlies, and so increase the orderlies' efficiency in the smaller units in whose establishments nurses could not be included.

In June 1940 Air Commodore Hurley recommended to the Air Member for Personnel that an air force nursing service should be formed, and in the same month the recommendation was approved by the Minister. The establishment of a reserve was also recommended, but approval for this was withheld until 1948. The R.A.A.F. Nursing Service which came into being on 26th July 1940, was modelled on the Princess Mary's Royal Air Force Nursing Service, with conditions and rates of pay similar to those of the army nursing service. The suggested provisional establishment was:

Laverton . . .	(200 beds)	12	nurses	initially,	increasing	to	20
Richmond . . .	(150 „)	10	„	„	„	„	15
Pearce	(100 „)	6	„	„	„	„	10
No. 1 Engineering School, Victoria .	(100 „)	6	„	„	„	„	10
Evans Head . . .	(40 „)	4	„	„	„	„	6

Miss M. I. Lang, who had served at Salonika in the 1914-18 War, was appointed Matron-in-Chief. She was attached to R.A.A.F. Headquarters in the Directorate of Medical Services and later was given status equivalent to that of a Director. Her functions were to direct and supervise the service, and to advise the D.G.M.S. on all matters concerning nursing in hospitals and in medical rehabilitation and other units and sick-quarters, and the appointment, posting, promotion and discharge of R.A.A.F. nurses. She was to be represented by a Principal Nursing Officer in each State or Territory of the Commonwealth and in all R.A.A.F. areas, groups and commands as the necessity arose. Miss M. K. Doherty, who became Matron of No. 3 R.A.A.F. Hospital on 16th September 1940, was the Principal Nursing Officer of No. 2 Training Group and for all units in New South Wales and Queensland.

The Matron-in-Chief visited each State to interview applicants and to make selections. She was assisted in New South Wales by Miss Doherty. Members of the nursing service were selected from some of the civilian nurses employed by the R.A.A.F., from the reserve of the Australian Army Nursing Service and from hundreds of volunteers from all over the Commonwealth. To achieve selection a candidate was required

(*a*) to be a female between the ages of 21 and 40 years, unmarried, or a divorcee or widow without dependent children under 16 years of age. (A female between 40 and 50 years could be appointed if she fulfilled the other requirements and possessed special qualifications);
(*b*) to be registered as a general nurse or masseuse in a State or Territory of the Commonwealth of Australia; and
(*c*) to have passed such medical examinations as were approved by the Air Board.

Members of the R.A.A.F. Nursing Service held the following ranks:

Matron-in-Chief: Group Captain
Principal Matron: Wing Commander
Senior Sister: Flight Lieutenant
Sister, Staff Masseuse: Flying Officer

In the early years of the war the lowest rank was Sister and Staff Masseuse Grade II, but from the 23rd March 1943 the first appointment was as Sister or Staff Masseuse. Members entered the Service on six months' probation, after which period, in the absence of an official adverse report, their appointment was confirmed. They were liable to render continuous service either within or beyond the limits of the Commonwealth of Australia, and were promoted on the same principle as male officers of the R.A.A.F. Their appointment was terminated at a prescribed age which varied from time to time, or on marriage.

The outdoor uniform of R.A.A.F. nurses was Norfolk coat and skirt —in winter of air force blue whipcord or barathea, in summer of drab gabardine—a white blouse, black tie and pin, fawn stockings, black shoes and black kid or nappa gloves, and a dark blue felt hat. A greatcoat of air force blue and a dark blue belted raincoat completed the outdoor uniform. Indoors, nurses wore a white cotton uniform with a shoulder cape of blue velour, white shoes and stockings, a white organdie veil and, when necessary, an air force blue woollen cardigan. Later a mess dress was designed of air force blue silk, with detachable collar and cuffs, and a cape. With this black court shoes and silk stockings were worn. Medical Branch badges were attached to uniforms and capes and officers' badges to hats. When the W.A.A.A.F. was formed a move was made to standardise the footwear of the women's services, and also prevent the fatigue and postural faults caused by unsuitable footwear. A committee was formed, and a comfortable flat-heeled, laced shoe, in multiple fittings, was designed.

When the Empire Air Training Scheme got under way at the end of 1940 52 members of the R.A.A.F. Nursing Service were attached to the

medical staff of the official escort parties which accompanied trainees overseas. Seven nurses were included in escort parties from Australia to the United States, and the rest in parties from Australia to Canada and the United Kingdom.

In October 1941 four R.A.A.F. nurses were posted to Darwin. They found their living quarters cool and comfortable, as were the station sick-quarters. The only complaint they might have had was that their life was a little monotonous. If so, this ceased to be true when Japan entered the war; the possibility of air raids was immediately envisaged, and orders were given that a practice evacuation of the hospital was to be carried out each day; the nurses had their belongings packed and patients were given tin hats and respirators and told to keep these, together with gown and slippers, by their beds. The efficacy of this drill was demonstrated on 19th February 1942. At 9.45 a.m. the air raid alarm sounded and within ten minutes the patients and staff had evacuated the hospital. Senior Sister I. M. Smith described the Japanese attack on the air force station which followed:

As we were going to our trenches we could see high up nine clusters each of nine planes. We were in the trenches for about half an hour when a formation flew over. They came down very low and stayed for 40 minutes which seemed like two hours. The relief was wonderful when we heard the all clear. We all went to our posts and attended to quite a few minor casualties and evacuated the patients safely to the 119th A.G.H. After a short interval we were back to our trenches to undergo a most awful experience.

The planes came over in perfect formation, and let us have it. The noise was terrific. A bomb exploded ten yards from our trench, and believe me, we thought our end had arrived. Although our trench was of rock formation, the vibration caused it to tremble, and the dirt and rubble fell on our backs and tin hats.

When the all clear sounded our S.M.O., Squadron Leader Howle, called for Senior Sister, and was surprised when we all hopped out of our trench in good condition. Apparently, he thought we had been buried when the bomb exploded so close to our trench. We shall never forget the sight which then met our gaze. The huge hangars were burning, also the equipment store, post office and the administrative block of the hospital, dental section, X-ray and dispensary. We went back to the hospital and rescued equipment which we had packed and stored in trenches.

Later we went to our quarters to prepare a meal for the staff and medical officer and found the water and light were cut off. Our home had been strafed and there were bullet holes in our uniforms which were hanging in our rooms. Just as we were going to have a snack the alarm sounded again and the sisters were ordered on to an American truck and were taken out to the bush. Fortunately we had been packed for several weeks previously. We stayed in the bush for two hours waiting to know our fate.

This turned out to be a period of duty at the 119th A.G.H., which, in addition to army, navy and air force patients, was overflowing with civilian patients. The R.A.A.F. nurses helped out at the army hospital until it was decided to transfer the air force station back to Daly Waters.

We went back to the R.A.A.F. Station for the first time since the raids, and boarded a Hudson, and left for Daly Waters (wrote Senior Sister Smith). It was

the first time for many a year that they had had no rain. It was very hot and dusty. We walked about one mile from the aerodrome to the little hotel which was the station sick-quarters, officers' and sisters' living quarters.

There were several patients with dysentery, dengue and malaria and an American airman very ill with blackwater fever. We firstly attended to the patients and secondly to the washing—there were stacks of soiled linen everywhere. It could hardly be called washing as there was not an atom of soap to be had anywhere.

When we first arrived we had an out-patients of 100, but they gradually decreased as conditions improved.

Flies were there in millions. The keeping of food was a problem as there was only one refrigerator for hospital patients and staff, but after the first week the Americans delivered ice daily, their camp being 20 miles away. Things were very quiet for the patients as there was nothing there for their welfare until the Red Cross representative arrived from Alice Springs.

The sisters adapted themselves fairly quickly to tropical conditions but for the first few weeks sandfly bites and minor skin conditions were troublesome.

Medical conditions at Daly Waters improved when No. 1 Medical Receiving Station was established on 25th March 1942. Six months later it was transferred to Coomalie Creek, 60 miles south of Darwin. Many of the men admitted to the unit there had been involved in aircraft and road accidents, some of the former suffering from first and second-degree burns. Such patients required special attention, and placed a heavy burden on the nursing staff in the trying conditions of the Territory. The nurses had to use primus stoves to cook special diets and to boil water for sterilising. Laundry facilities were poor, and on occasions when the mobile laundry was out of order the nurses had to do the washing. Their indoor uniform veils had a tendency to go limp in the heat, and they found it almost impossible to keep them neat. Night duty was exhausting owing to the difficulty of sleeping in the day when it was hottest, and 7 to 10 days' night duty was about the most anyone could stand.

A lesson learned from the Darwin raid was that the nurses' white uniforms were clearly visible from the air, and formed targets for enemy aircraft. To remove this hazard an instruction was given in March 1942 that the white uniforms of nurses serving in forward areas were to be dyed drab, strong tea to be used for the purpose.

In November 1942 four nurses were posted to No. 3 M.R.S. at Port Moresby. The M.R.S., situated in the almost treeless June Valley beside Ward's Airfield, was set up in widely dispersed tented wards. The nurses were also accommodated in tents. Mosquitoes were bad, and the uniform for malarious and potentially malarious areas was issued, consisting of drab, long-sleeved shirts or safari jackets, shoulder straps with detachable rank braid, drab slacks, black boots and canvas gaiters and fur felt hats with R.A.A.F. puggaree and flash. This was to be worn from sunset until after sunrise; during daylight hours the normal indoor uniform was worn.

Work in the wards was heavy, and sleep was often disturbed by enemy aircraft, the nurses having their first experience of an air raid on their second night in Papua. Despite the difficult conditions, their health remained good.

In July 1942 Air Vice-Marshal Hurley had instructed Principal Medical Officers that recommendations for positions and attachment of nurses were only to be made after consultation with the Principal Nursing Officer in the area or group concerned. In the case of No. 2 Training Group and all units in New South Wales and Queensland this was Matron Doherty. The responsible member in the Western Area was Sister N. M. F. Monger, Sister-in-Charge at the R.A.A.F. Station, Pearce; and in South Australia Senior Sister L. E. Dohnt, Sister-in-Charge of the R.A.A.F. Wing, Royal Adelaide Hospital.

By the end of 1943 there were large numbers of nurses serving in operational areas, and in October the D.G.M.S. recommended to the Director of Organisation that the Matron-in-Chief should have an officially accredited representative in No. 9 (Operational) Group, North-Western Area, and each of the capital cities, as she had already in Sydney and Perth. As a result, the establishment was amended to provide for:

No. 1 Training Group—Matron Dohnt was appointed for duty with the Deputy Principal Medical Officer, Adelaide, on 12th April 1944.

No. 2 Training Group—Matron E. E. Ward was appointed for duty with the Deputy Principal Medical Officer, Brisbane, on 21st June 1944.

No. 9 (Operational) Group—Matron A. J. Wheatley was appointed for duty on 24th November 1943.

No. 1 Medical Receiving Station—Matron C. J. McRae was appointed for administration duty when required with the Principal Medical Officer, Western Area, on 29th April 1944.

It was not considered that purely administrative appointments to North-Western Area and North-Eastern Area would be justified as the matron of No. 1 Medical Receiving Station would be able to undertake any administrative duties necessary in the North-Western Area, while the area of the matron in Brisbane covered the whole of Queensland, including North-Eastern Area. The matron at R.A.A.F. Headquarters was responsible for duties in Tasmania as well as in Victoria and the matron of No. 9 (Operational) Group was required to supervise all aspects of nursing in medical receiving stations, medical clearing stations and convalescent depots within that group to which sisters were posted. In May 1944 it was considered that a matron was required at No. 1 Training Group for duty with the Principal Medical Officer, Melbourne, and Matron Wheatley was given this appointment on 22nd August 1944. Her responsibilities included the supervision of nursing in units in Tasmania to which members of the service were posted.

The Matron-in-Chief had one assistant at R.A.A.F. Headquarters, Senior Sister M. G. Greening. With the expansion of the service further assistance became necessary, and on 9th September 1943 Matron N. M. F. Monger was appointed to the staff of the Matron-in-Chief, and in September 1945 Senior Sister J. H. Kelly. Sister Kelly's duties were concerned almost entirely with equipment.

The instruction of trainee nursing orderlies in general nursing procedures had been the responsibility of senior medical orderlies, but at

the beginning of 1943 this duty was taken over by members of the nursing service. It was decided also to train members of the W.A.A.A.F. as sick-quarters attendants and nursing orderlies, and their training likewise became the province of the nursing service.

Training was carried out in the wards of hospitals and sick-quarters until March 1943 when an establishment was made for a sister tutor at the medical training section, R.A.A.F. Station, Laverton, and simultaneously three tutor sisters were selected for advanced training in R.A.A.F. hospitals. Their number was later increased to eight, all being occupied on full-time training. In August, when a special unit was established for the training of medical personnel at "Larundel", Victoria, a senior sister and a sister were included on the teaching staff. During the nurses' period at "Larundel" over 600 men successfully completed the courses held there for medical orderlies.

The training of W.A.A.A.F. personnel interested in nursing was carried out in three phases, in each of which the nursing service participated. An initial general nursing course of three weeks' duration for girls without any experience was instituted in May 1943, and carried out at both the training centres. The second phase of training, consisting of lectures on elementary anatomy and physiology, hygiene and general nursing, was given at all units by a medical officer and members of the nursing service. After completing twelve months' service and passing the Phase 2 examination, sick-quarters attendants were posted either to No. 1 Hospital, Wagga, New South Wales, No. 3 Hospital, Concord, New South Wales, or to No. 6 Hospital, Heidelberg, Victoria, where Phase 3 of their training, a three-months course in advanced nursing, was held. Lectures were attended daily and practical experience gained in the wards under the supervision of a tutor sister. On satisfactorily completing this course a W.A.A.A.F. sick-quarters attendant was eligible for remuster to nursing orderly.

In February 1944 the Air Board approved of the inauguration of a medical air evacuation transport unit and in the following month No. 1 M.A.E.T.U. came into existence. Nurses were included in its establishment and applicants for air evacuation duties were called for from nurses within the service who were:

between the ages of 21 and 30;
at least 5 feet 4 inches in height;
not more than 130 pounds in weight;
medically fit A4B;
recommended by the commanding officer of hospital or senior medical officer of unit to which the sister was attached at the time of application.

When applications closed 100 sisters had volunteered, and the first 15 were selected and posted to the Medical Training Unit for two weeks' special training. Senior Sister N. I. Kendrick, an original member of the R.A.A.F. Nursing Service, was appointed Sister-in-Charge.

Later a second medical air evacuation unit, No. 2, was formed, and nurses were included in its establishment also.

Both the outdoor and working uniform of nurses serving in medical air evacuation units were the same as that for malarious areas, except that a blue field-service cap could be worn instead of a hat, and, for high altitudes, a blue fur-lined flying jacket with rank braid on shoulder straps was added. Several types of combination flying suits had been tried, but none proved so successful or comfortable as the slacks and shirt, worn with a jacket if necessary, while the cap was ideal for working in the aircraft.

The aircraft of the M.A.E.T.U's flew into forward areas while fighting was still going on to bring out the wounded, but it was not until the war was over that there were any casualties among the nurses of the units. Sister M. E. Craig of No. 2 M.A.E.T.U. was killed when the aircraft in which she was flying with wounded men crashed between Biak and Merauke in Dutch New Guinea on 18th September 1945. Sister V. B. Sheah of No. 1 M.A.E.T.U. was killed in an aircraft accident on 15th November 1945, while tending wounded servicemen on board an aircraft which left Jacquinot Bay for Rabaul.

The M.A.E.T.U's made an outstanding contribution to the air evacuation of former prisoners of the Japanese. Sister H. A. Cleary, who took part in the work, has described the airlift of former prisoners to Singapore:

It was my privilege to be one of the first of three R.A.A.F. Nursing Sisters to fly our boys from the various prisoner-of-war camps back to Singapore. The other sisters concerned were Senior Sister M. A. Braid and Sister M. H. Wroe. We were only allowed to take 35 pounds of baggage, including medical kits.

Because of lack of information regarding the situation in Singapore, several paratroopers were on the Dakota to jump with rations and equipment should we be unable to land. The aircraft would then return to Labuan to await further orders. However, our landing at Singapore was uneventful. We were the first Australians to arrive; this was about ten days after the surrender of the Japanese.

The British, who preceded us by a few days, were dismayed to find sisters arriving and feared for our safety owing to the presence of 40,000 armed Japanese who were still on the island, and thought we should return to our base at Morotai. However, we impressed on them that we had vital work to do, so accommodation was found for us at one of the hotels. When I say accommodation, conditions were very primitive. We slept on the floor on a blanket, having no lights or water for toilet facilities, and rations as you can imagine were very scarce, but the main point was that we stayed.

On the night of our arrival we met many Australian prisoners. They were hungry for news, especially of home, and we talked incessantly, answering their innumerable questions. The next morning we went out to visit Changi prison camp to see the Australians, especially those who were so ill. . . . It was impossible to realise all they had been through. I recall that one of the worst cases we saw at Changi was an Englishman who weighed less than 4 stone.

I had thought when evacuating battle casualties from the front lines that we were doing an important job, but here was something much bigger, and it was our aim to get the prisoners back to civilisation and decent conditions, where they could be nursed to health as quickly as possible. And so our work began. More suitable accommodation had to be found, and preferably as near to the Kallang airport as possible. By this time another five sisters had joined us and later still four more arrived. We flew British servicemen and Dutch civilians as

well as our Australian boys from the camps in Java, Thailand and Sumatra to Singapore, where many of them spent some time in hospital before returning to their homeland.

So many things seemed to be happening, as we were flying every day, always without normal navigational or radio aids. On the short trips we would do a shuttle run, while on the longer trips, on which sufficient fuel had to be carried for the return flight, an overnight stay was necessary. Varied were the places in which we were accommodated, from an Indian medical detachment to a Thai officers' mess. The planes were loaded beyond capacity. The Dakota has a loading capacity of 27, and we often had as many as 46 on board, which did not leave much room for moving around, but it seemed so hard to leave anyone behind even for only one more day. Most of the evacuees were suffering from malnutrition and dysentery, so the general conditions within the aircraft can well be imagined, and practical nursing as we know it was impossible.

There is one other aspect of my stay in Singapore that stands out in my memory. It was the formal signing of the surrender. Thousands of Asians lined the streets for miles along the route to the building. Allied servicemen who had arrived since the surrender were most spectacular in their different uniforms, and of course the air forces of the Allies were in evidence over the area, flying in formation displays during the actual signing of the document. After the arrival of Lord Louis Mountbatten and party six high ranking Japanese officers were brought forward and taken into the building and ceremoniously stripped of their swords. Although we missed witnessing this climax, the occasion was memorable with the crowds, the Japanese arrogant even in these circumstances and everywhere feelings running high.

Although the entire air lift took only about one month, with such consistent flying and early rising, it seemed much longer. However, it was a most rewarding experience.

Membership of the R.A.A.F. Nursing Service had expanded from 45 in December 1940 to 616 in December 1945. At the end of hostilities plans were made for demobilisation. This was arranged on the points system, sisters being given three points for each year of age on enlistment plus one point for each month of service to the end of the war in the Pacific. First postings for demobilisation were made from the 3rd January 1946 when fourteen members of the service were released.

In September 1948 a peace-time service was formed. The nursing of members of the R.A.A.F. in the period between the end of hostilities and the formation of the peace-time service in 1948 was performed by sisters of the R.A.A.F. Nursing Service who volunteered to serve in the Interim Air Force. A number of these sisters were appointed to the permanent service.

PART III

WOMEN IN THE ARMY MEDICAL SERVICES

CHAPTER 33

WOMEN OFFICERS IN THE A.A.M.C.

THE authority for appointment of medical officers in the A.A.M.C. described them as "persons legally qualified to practise medicine" and the word "persons" was not interpreted to include women until 1940. A precedent was given by a British War Office Order which on 17th October 1939 authorised the commissioning of women in the R.A.M.C. On this model the commissioning of women graduates in medicine in the A.A.M.C. was introduced in Australia on 10th July 1940, when the Military Board stated the terms of such appointments. These granted women medical officers equal rank on first commission, equal chance of promotion and equal rates of pay and allowances with male medical officers. The first woman commissioned in the A.A.M.C. was Captain Lady W. I. E. MacKenzie, M.B., B.S., who was appointed on 25th September 1940 after a period of six months' work in administrative duties in a voluntary capacity. After this more medical women were commissioned, mostly as specialists in general hospitals, but some for general duties and administration. As women medical officers in A.A.M.C. units increased in numbers some difficulty arose about their status. This was clarified in a memorandum by the D.G.M.S. on 9th February 1943, which informed all areas that women medical officers were to be given the privileges of officers' rank and medical status, including right of membership of the officers' mess. The D.G.M.S. pointed out that no medical officer should be placed in an invidious position.

Assistant Pathologists. Grouped with these were the biochemists, and all science graduates who assisted the pathologist medical officer in a general hospital. These officers were not always commissioned on first joining the army; some held the rank of sergeant and, until 1st September 1944, were A.A.M.W.S. officers on promotion. The first woman assistant pathologist was Captain M. L. Freeman, B.Sc., who, in April 1940, went to the Middle East with the 2/2nd A.G.H. as a voluntary aid. She was commissioned as a lieutenant in the A.A.M.W.S. on 20th May 1942 and appointed an assistant pathologist. Promotion among assistant pathologists, male and female, was governed by the ratio of one captain to four lieutenants.

Pharmacists. Pharmacists also were sometimes enlisted as N.C.O's, and promotion was made on recommendation, and when vacancies existed. Staff-Sergeant G. J. Richardson, promoted in 1944 to lieutenant in the A.A.M.C., was the first woman pharmacist appointed in the army.

Physiotherapists. At first female physiotherapists, then called "masseuses", were not enlisted in, but attached to the army. Though accorded the privileges of officers they were not commissioned in the A.A.M.C. as physiotherapists till early in 1942. As these appointments created an anomalous position the physiotherapists were transferred to

the A.A.M.W.S. in July 1943 but retransfer was made later to the A.A.M.C. Further particulars of these officers are given in a later chapter.

Dietitians. Qualified dietitians were commissioned as lieutenants, with provision for promotion, and were appointed to the large base hospitals. All commissions were at first in the A.A.M.W.S., but, after September 1944, in the A.A.M.C.

Occupational Therapists. The history of these women officers is given in another section; they were appointed only to static hospitals.

It may again be noted that administrative difficulties with regard to status and pay arose in respect of the appointments of all women officers in the A.A.M.C. except medical officers. The device of commissioning them in the A.A.M.W.S. proved unsatisfactory and was abandoned. The aspects of these troubles as they concerned women serving in various technical capacities are dealt with in the sections on individual services. In the main, grouping the members of such services in the A.A.M.C. was satisfactory, and ensured all of them equal rights. As they were all specialists, once they were commissioned no training problems arose except those concerned with army administration. This problem was dealt with where necessary by sending officers on appointment to the Army Women's Services Officers' School.

Women officers in the A.A.M.C. had opportunities for oversea service, and in other respects had the same conditions of service as officers in other women's services; benefits, allowances and pay were the same for all women officers except medical officers. The question of equality of pay for men and women carrying out special technical work in the armed Services is not discussed in detail here, but there was surely good reason for the resentment felt by many highly qualified women at the inflexibility of military procedures.

CHAPTER 34

PHYSIOTHERAPISTS

THE official civilian organisation of physiotherapists in Australia was known for a number of years as the Australian Massage Association. At a conference held in May 1939 it was decided that "massage" was a misnomer, the field of physical therapy being much wider than was implied by the word, and that the name of the organisation should be changed. It has since been known as the Australian Physiotherapy Association.

As far back as 1935 the organisation's Federal Council approached the D.G.M.S. Army with the suggestion that a massage unit should be formed for service in time of war. During the 1914-18 War there had been a year's delay before a massage unit or masseuses began work, and it was obviously undesirable that this should happen again. During 1937-38 the matter was kept alive, and in December 1938 provision was made on the staff of 1,200-bed hospitals for one warrant officer masseur and 9 masseuses, whereas previously only one masseuse had been provided, and on the staff of 600-bed hospitals for one warrant officer masseur and 4 masseuses.

On the outbreak of war female physiotherapists began to join the Australian military hospitals. Still known as masseuses, they were not enlisted in, but attached to the army. At this time there was no intention of giving them commissions, although they enjoyed all the privileges and courtesy of commissioned rank while having the equivalent rank of sergeant. Nor was there any intention of forming a separate corps or unit.

The physiotherapists' uniform was distinctive—an air force blue skirt and jacket with cerise epaulettes and tie.

One male staff-sergent and four female physiotherapists were appointed to the 2/1st A.G.H., which left Australia for the Middle East in January 1940. Thereafter each of the general hospitals proceeding to the Middle East contained its quota of physiotherapists. There was special emphasis on their work at the 2/1st A.G.H. at Gaza and the 2/2nd A.G.H. at Kantara East. At the 2/1st A.G.H. a Thoracic Unit was established to carry out research on the restoration of function to injured lungs. Patients were given re-education in breathing, and as a result many were restored to Class A physical fitness. At the 2/2nd A.G.H. an orthopaedic centre was set up.

During 1941 Australian physiotherapists continued to serve throughout the Middle East, in British as well as Australian hospitals, and they were also posted to hospitals in Eritrea, in Greece, Crete, Malaya and Ceylon. Four of the units with which they served came under fire. These were the 2/5th and 2/6th A.G.H's and the 2/10th and 2/13th A.G.H's. The female staffs of the 2/5th and 2/6th were evacuated from Greece, and later from Crete, with only a very narrow margin of safety. When the fall of Singapore was imminent nurses and physiotherapists belonging

to the 2/10th and 2/13th A.G.H's were ordered to leave. The physiotherapists and some of the nurses embarked in a ship which, although subjected to heavy air attack, managed to reach Australia safely.

From the beginning of 1943 physiotherapists were posted to hospitals in the South-West Pacific Area. They also served throughout the war in hospital ships and ambulance sea transports. In all, about 80 of them saw active service abroad.

Meanwhile in Australia problems of organisation and administration had arisen in 1941 which were not to be resolved until three years later. On 9th October 1941 the Federal Council of the Australian Physiotherapy Association submitted plans for increasing the efficiency of physiotherapeutic services. It was suggested that a chief physiotherapist should be appointed to Army Headquarters, and a principal physiotherapist to each of the larger medical units. The allotment of staff could thus be coordinated, and conditions standardised. It was further suggested that where necessary occupational therapists should be attached to departments.

Agitation had begun for the grant of commissioned rank for physiotherapists, although this did not originate from the official association. In December 1941 an amendment to *A.M.R. and O.* authorised the appointment in the A.A.M.C., with the rank of lieutenant, of all persons with special qualifications in any branch of scientific or medical knowledge ancillary to medical science. The D.G.M.S. pointed out that all physiotherapists then serving would thus be appointed as lieutenants.

Pay was another controversial issue, as male physiotherapists could receive 16/- per day while females doing the same work received 9/2 per day, with small additions in the A.I.F. The D.G.M.S. considered that there was no reason why women physiotherapists should not receive pay for the rank of lieutenant, and after considerable discussion—legal, financial, departmental and political—the increased rates were approved. The Chief Finance Officer, however, advised that discontent was certain to arise throughout the women's services, and that the members affected should be transferred to the A.A.M.W.S., so as to stabilise rates of pay. These discussions went on through 1942. Naturally, the projected transfer of numbers of scientifically trained women from a senior service (A.A.M.C.) to a junior service (A.A.M.W.S.), with consequent loss of pay and status, interested the various societies watching the rights of women on military service, and the arguments continued well into 1943.

The Physiotherapy Association refrained from controversy, but pressed for the appointment of a Chief Physiotherapist. In February 1944 this point was won and Captain A. A. McArthur Campbell was selected. Captain Campbell had been among the first women physiotherapists to come forward in 1939. She had been called up in 1940, and attached to the 2/4th A.G.H. with which she served in Egypt, Libya and Palestine.

Now under the immediate control of the Director of Surgery and working from the office of the Controller of A.A.M.W.S., she began a reorganisation of the service. A seniority list was compiled, and 26 of the senior members were promoted to the rank of captain. Staff was dis-

tributed according to the requirements of medical units. There was at the time a certain shortage of staff in the medical units, due largely to administrative troubles which had reduced recruiting for the army, available graduates preferring to join the navy and air force. These troubles were in fact not yet over. The Federal President of the Australian Physiotherapy Association drew the attention of the Acting Minister for the Army to the continuing dissatisfaction of women physiotherapists with their transfer to the A.A.M.W.S. Captain Campbell asked the physiotherapists of all units to refrain from any request for a male rate of pay, as this was a political issue, but various bodies and individuals represented strongly the rights of the scientific women. On 1st September 1944 the physiotherapists and scientific women workers who had been grouped with the A.A.M.W.S. were returned to the A.A.M.C. with the pay of women's services officers. This was a much more satisfactory arrangement, but hardly pleased those who had enlisted in 1942 as A.A.M.C. officers on the male rate of pay.

It would seem that the involved problems raised in the technical branches of the women's services were, in part, due to greater expansions than had been foreseen and perhaps, too, to an official failure to recognise the administrative issues created by such expansions.

Types of work done. Physiotherapists carried out work of wide variety and frequently of technical difficulty. Its close relationship to traumatic surgery in its applications to war, and to the remedial possibilities in many incapacitating conditions gave physiotherapists an important function which they discharged with great ability. Their field comprised the preparation of plaster in various forms and the application and removal of plaster casts, the encouragement of muscular function in a wide range of medical and surgical conditions, work in orthopaedic wards, fitting of boots, care of the feet, supervision, splinting and treatment of nerve injuries, work with long-term cases in convalescent depots, and the rehabilitation of seriously affected soldiers, in particular prisoners of war.

Equipment. In 1940 there were no standards which could be successfully applied to equipment for physiotherapeutic departments. They differed so widely in requirements, the types of patients handled and their length of stay in hospital that standardisation was difficult. Much equipment used in the field, and even in base areas, was improvised. In the tropics the physiotherapists had to adapt their equipment to the extremely moist conditions. The usual loose plaster issued was swiftly affected by the high humidity, as were all hand-rolled bandages, which had to be wrapped in paper singly, dried out in ovens and then packed in air-tight tins.

Unit funds sometimes provided the means of buying material locally which could be made into useful apparatus by unit labour or by the efforts of patients. The Red Cross Society on many occasions provided much-needed equipment.

In 1941-42 scales of equipment were drawn up for the chief base hospitals in Australia, which also profited by gifts from the Red Cross and other voluntary organisations. The chief physiotherapist later worked on this scale, which was amended in 1944. The chief items were hot

air baths, Bristow and galvanic outfits, inductotherm, infra-red lamps and special mechanical exercisers. Ordnance supplied couches and mirrors, so useful in stimulating rehabilitation of nervous and muscular injuries. In the large base hospitals well-equipped gymnasiums were part of the physiotherapy department, and were of great assistance in the general rehabilitation program.

CHAPTER 35

OCCUPATIONAL THERAPISTS

OCCUPATIONAL therapy in the armed forces, as in the civil community, has had to contend with considerable misunderstanding of its scope and application. It is, after all, one of the therapeutic offshoots of social medicine, a subject dignified by chairs in an increasing number of universities.

In June 1941 a recognition of the growing need for organised therapy in the military hospitals led to an official decision to appoint qualified occupational therapists, who were provided for in the war establishments of base hospitals, and who were to hold officer rank in the V.A.D. organisation. In December 1941 the Director-General of Medical Services directed the attention of the Adjutant-General to the need for necessary facilities for occupational therapy, and affirmed that the Department of the Army recognised the value of this specialised work in the treatment of mental disorders and of disabilities or deformities resulting from injury or disease. The latter category included conditions encountered both in general medical or surgical maladies and in orthopaedic practice. Miss J. M. Keam was appointed to the 115th A.G.H., Heidelberg, and Miss E. M. Francis to the 113th A.G.H., Concord. The accommodation provided in the base military hospitals in all States was not in any instance adequate, but it at least provided a basis for future expansion. Occupational and physiotherapy units were also formed in most of the convalescent depots, which offered opportunity for instruction in heavy crafts. Recreational facilities were provided by the Red Cross in hospitals and hospital ships, and liaison had been made with this organisation so as to ensure effective cooperation. Arrangements were also made with the Army Education Service for assistance in related fields of work.

The need for staff was met by training occupational therapists, and technical assistants. There were at this time only three women in Australia holding diplomas in occupational therapy: Miss Keam, Miss Francis and Miss S. B. Docker. Miss Docker was approached by some orthopaedic surgeons on behalf of the N.S.W. Physiotherapy Council with a view to establishing a school of occupational therapy, and a two years' course was organised by the Australian Physiotherapy Association to train occupational therapists primarily for work in military hospitals. Twenty-five students were specially selected for this course, and to cope with the emergency the army chose, in addition, one nurse and four physiotherapists to take an accelerated course of six to nine months, after which they were posted to fill vacancies in base hospitals. Further assistance was obtained by using technical assistants in the departments who had special technical qualifications. Most of these were recruited through the V.A.D. organisation, and were later classified as occupational therapy assistants. Some specially selected trainees, after a year's work under fully-trained therapists

in base hospitals, were given further training at the school. After this they graduated as qualified occupational therapists and were commissioned as lieutenants in the A.A.M.W.S., the first of them taking up duty in April 1944. Experience proved the wisdom of not unduly abbreviating the courses of instruction.

It was recognised in 1941 that occupational therapists would be able to cope only with purely remedial treatment, and that diversional therapy would be quite distinct. The Australian Red Cross Society appointed craft workers and voluntary helpers to provide purely diversional occupations, designed to help patients by relief of tedium. Some misconception occurred at times with regard to the relation between remedial and diversional occupational therapy, some of it, surprisingly, among doctors, who were not invariably as fully apprised of the benefits of skilled occupational treatment as they might have been. In 1943 the Adjutant-General directed that, in hospitals with full-time occupational therapists on the staff, Red Cross Society craft workers should be under direction and control of the army occupational therapist. This plan allowed the delegation of all purely diversional occupation to workers of the Red Cross Society which appointed no occupational therapists as such.

In June 1943 an occupational therapist was appointed to the staff of the D.G.M.S. at Army Headquarters to coordinate and direct all such work in military hospitals. Gradually the organisation expanded with the appointment of trained officers in the A.A.M.W.S. to establish departments in psychiatric and orthopaedic divisions of general hospitals. At the end of the war there were 30 trained occupational therapists in the army. In accordance with alterations in the constitution of the A.A.M.W.S. these women were transferred to the A.A.M.C. There were also numbers of trained and experienced assistants who maintained a valuable liaison with the physiotherapy department, the medical social service of the Australian Red Cross Society and the Army Education Service.

Equipment was standardised in 1943 and a wide range of tools and apparatus was laid down. Many articles were made in the workshops of the Australian Electrical and Mechanical Engineers to the specification of the D.G.M.S., and items on the official scale were obtained through the Ordnance Branch. Expendable stores were obtained by a central buying system through the D.G.M.S. Arrangements were also made for the sale of articles made by patients.

The general organisation in 1945 aimed at concentrating this special form of service in 12 hospitals in base areas where long-term patients were held. Work carried out in other hospitals was diversional.

Some extension was made in addition to convalescent depots, where it was found convenient for the occupational therapist to visit the unit weekly with the orthopaedist, both of whom acted as specialist advisers. The value of these activities was heightened when questions of rehabilitation of soldiers became more pressing. The trend of occupational therapy in the light of war experience may be well seen in a discussion on handicrafts circulated by Major J. M. Keam. In this she refers to the query

raised in Great Britain and America whether handicrafts are the best medium for this work. Apart from former confusions with diversional activities, the "scourge of pink elephants and plague of rabbits" may serve an end other than its immediate purpose by challenging trained occupational therapists to demonstrate by work and results that the "scientific application of purposeful activities" can supply more normal occupation and more apt and prompt rehabilitation. Purposeless occupation can be harmful; in convalescence occupation needs not only stimulation but direction. The duty of the medical officer to guide the patient into convalescence is evident: "The view horizontal" must be exchanged for "the view vertical". The close relations maintained between psychiatrists and orthopaedists in their special departments with physiotherapists and occupational therapists emphasise the particular value of these branches of social medicine.

In the 114th A.G.H., a largely psychiatric hospital, 80 per cent of the patients were referred to the occupational therapist by Lieut-Colonel A. J. M. Sinclair and his staff, and rounds were conducted twice weekly with medical officers in conjunction with the therapist, who advised on forms of activity. In February 1946 after the 114th A.G.H. was disbanded, the numbers of patients having occupational therapy at Concord Military Hospital were: medical 206, surgical 442, orthopaedic 499, and psychiatric 1,141.

CHAPTER 36

THE AUSTRALIAN ARMY NURSING SERVICE

BETWEEN the wars the Australian Army Nursing Service existed only as a reserve, and in this respect was at a disadvantage compared with the British service, the Queen Alexandra Imperial Military Nursing Service, which had a permanent nucleus. In Australia records were kept in each State of trained nurses appointed to the reserve and willing to serve in time of national emergency, but the reservists were given no training in military procedures, and no attempt was made to use their services even in militia training camps, from which the sick were sent to civil hospitals. A matron-in-chief attached to the staff of the Director-General of Medical Services at Army Headquarters administered the A.A.N.S., and in each State there was a principal matron who was responsible to the Deputy Director of Medical Services. The matron-in-chief and principal matrons were required to give a certain number of days each year to military duty.

From 1925 to 1940 the Matron-in-Chief was Miss G. M. Wilson. Late in 1940 Miss Wilson was sent overseas as Matron-in-Chief of the A.I.F. abroad, and Miss J. Sinclair Wood was appointed Matron-in-Chief at Army Headquarters, where she served until 1943. On her return to Australia in 1941 Miss Wilson retired. By this time Miss A. M. Sage, who had been in the Middle East, had also returned to Australia. Miss Sage took over as Matron-in-Chief, serving in this capacity until her retirement in 1952.

On the declaration of war in 1939 nurses were mobilised for service in the army both from the civilian community and the Army Nursing Service Reserve. There were approximately 13,000 trained nurses in Australia, and 600 on the army reserve. In the early months of the war volunteers far exceeded requirements, and by 1940 about 4,000 applications had been received for oversea service.

To be eligible for appointment an applicant had to be:

(*a*) a trained nurse, registered by the Nurses Board in a State of the Commonwealth of Australia, preferably with several years' general nursing experience as well as an additional nursing certificate;
(*b*) a British subject domiciled in Australia;
(*c*) single, or a widow or divorcee without dependants;
(*d*) between the ages of 25 and 35 years for oversea service in the case of sisters and staff-nurses, and below the age of 40 in the case of matrons;
(*e*) passed fit A1 by medical examination;
(*f*) of good character with personal attributes essential to the making of an efficient army nurse.

The ranks to which nurses were appointed in the A.A.N.S. were, in ascending order: staff nurse, sister, senior sister, matron, principal matron and matron-in-chief. Senior sisters were appointed as charge sisters in camp hospitals and casualty clearing stations, and in wards and operating

theatres; they also filled specialist positions in larger units. Military ranks were not used at the time, but all members of the A.A.N.S. were subject to military law and discipline.

The uniform of the Service had been modelled on that of the Q.A.I.M.N.S., and, despite changes made to suit variations of fashion, climate and conditions, the traditional grey and scarlet were retained. At the beginning of the 1914-18 War nurses had worn grey serge dresses which swept the ground and bonnets tied under the chin with bows. Their counterparts in the 1939-45 War dressed more comfortably. The standard outdoor uniform was a grey melange Norfolk jacket and skirt, the skirt 14 inches from the ground, a white silk shirt with a chocolate-coloured tie and a silver Commonwealth pattern brooch, brown laced shoes, fawn lisle stockings, brown leather gloves and a grey felt hat. Indoors, nurses wore a grey cesarine overall buttoning from neck to hem, with white starched linen collar and cuffs, a white organdie cap and a shoulder cape of scarlet cloth. The mess dress was of grey silk, made to the same pattern as the indoor uniform, with white organdie collar and cuffs, a white organdie cap, a cape of scarlet silk, grey silk stockings and black court shoes. There was as yet no proper summer uniform.

Senior sisters wore two narrow chocolate-coloured bands above the cuff of the ward dress and a narrow grey band on the epaulette of the Norfolk jacket. Matrons wore chocolate coloured cuffs with the ward dress and two or more narrow grey stripes on the epaulettes of the Norfolk jacket.

In 1942 there was a move to dress the A.A.N.S. in khaki, and the nurses had a struggle to retain their grey and scarlet uniform. The desire to keep it was inspired partly by sentiment and partly by the knowledge that the grey uniform was a relief to patients who were weary of the sight of khaki after having seen nothing else while they were in the field.

Nurses were appointed to general hospitals and to casualty clearing stations, the basis of distribution in 1940 being: 80 to a 1,200-bed, 50 to a 600-bed and 26 to a 200-bed hospital, and 8 to a casualty clearing station. In 1942 the number of nurses for 1,200-bed hospitals was increased to 120, and for 600-bed hospitals to 75.

In the early months of the war a number of nurses, some of them awaiting embarkation, were sent to camp hospitals. Most of the patients there were suffering from ordinary epidemic illness, and often required considerable care. The move was strongly resisted by a few Deputy Directors of Medical Services who considered that it would be impossible for nurses to adapt themselves to conditions in the camps. It was true that conditions were difficult; in the early days in some camps there was no accommodation for nurses; hygiene was poor; medical and nursing equipment and supplies were scarce; and sometimes patients had to be treated under canvas or in converted, unlined huts without proper heating, and in a few instances without bedsteads. Nevertheless, the nurses carried out their duties efficiently. They also helped in the training of

nursing orderlies, and they themselves were trained in army organisation and became accustomed to army routines.

Middle East: On 9th January 1940 the first contingent of A.A.N.S. under Matron C. A. Fall embarked for overseas in the *Empress of Japan.* They were the nursing staff of the 2/1st Australian General Hospital, which was to provide hospitalisation for the 6th Division in Palestine. The unit arrived in February, and proceeded to establish a hospital at Gaza Ridge. It was bitterly cold, and the nurses suffered as they were not equipped with warm clothing. They found that the hospital area consisted of 160 acres of ploughed land, with a kitchen, officers' mess, sisters' mess, store rooms and tents for sleeping. Three showers—there was no hot water—and three latrines completed the hospital equipment. Rioting among the Arabs and Jews made it unsafe for them to leave the camp, and within the camp they were forbidden to move far except in groups. The first time they went out was at the invitation of the British residents of Gaza; armed policemen travelled in the cars with them, and an armoured car led and another followed the rear of their party.

The hospital was officially opened on 16th April. It consisted of two marquees to which more were added as the bed state increased. The marquees were sunk well into the ground to camouflage them from the air, and the first heavy rains flooded them out. They were then pitched at ground level and for protection were revetted with sandbags or mud brick walls. Later hutted wards and a theatre were built. By October all patients were accommodated in huts, but the bed state continued to increase until there were 2,200 men in hospital, and tents had to be put up again. Because of the haste with which the first convoy had been dispatched there were many deficiencies. There was no sewerage and hygiene problems were manifold; water was limited with only one tap between two wards; the same primus was used for heating water, for washing the patients and for making hot drinks, and sterilisation in the wards was also by primus, although there was an autoclave in the theatre. Drugs were inferior in quantity and quality, but food was plentiful and good; it was taken round to the wards in trucks. In June 1940 Italy entered the war; a permanent blackout was imposed and slit trenches were dug everywhere.

A second body of nurses under the leadership of Matron Sage had left Australia for the Middle East on 15th April 1940. On arrival they were fostered by the 2/1st A.G.H. until their own units became operative.

During the year Ambulance Sea Transport Companies were formed to provide medical staff for transports sailing between Australia and the Middle East, and sixteen nurses were appointed to each company.

United Kingdom: A third party of thirty-two nurses under Sister E. J. Bowe left Australia for the Middle East on the 5th May in a convoy which included the *Queen Mary, Aquitania, Andes, Mauretania* and the *Empress of Japan, Empress of Canada* and *Empress of Britain.* When Italy entered the war in June they were in the Indian Ocean; their destination was changed to the United Kingdom, and course was set for

the Cape of Good Hope. On the way up the West African coast other ships joined the convoy whose escort at one stage included the battleship *Hood,* the aircraft-carrier *Argus* and a flotilla of destroyers. They arrived in England on 16th June 1940. Next month the Australian nurses in England were inspected on Salisbury Plains by King George VI, who was received by Sister Bowe.

Another Australian medical party, with forty-two nurses under Matron E. D. K. Butler, sailed for England in the *Stratheden* on 27th May. For part of the way it was escorted by H.M.A.S. *Australia,* but at Sierra Leone the Australian cruiser departed and did not rejoin its charges until some days later. The nurses learned that in the interval *Australia* had gone to join the engagement against the French fleet at Dakar. The nurses in the *Stratheden* reached Liverpool on 16th July, and when four more arrived within the next few weeks the total strength of the Australian Army Nursing Service in England was brought up to 78. All the nurses, with the exception of six who were attached to Tidworth Military Hospital for a short period, went to the 2/3rd A.G.H., which opened at Godalming in Surrey on 1st August 1940.

At Godalming the nurses lived in three huts. These were clean and new, and each had a good supply of hot water, and a coke stove which could be kept alight day and night when necessary.

The summer of their arrival was dry and warm. In London, 32 miles away, the blitz was raging, and during September districts around the hospital were severely bombed. At Godalming slit trenches were dug, air raid shelters built, and anti-gas drill carried out. Frequently the air raid alarm was sounded, and then the nurses would have to don steel helmets and work in them until the all clear was given. On some nights the raids went on for as long as 12 hours, but no bombs fell in the hospital area.

The work in the hospital was mostly medical, and was carried out under difficulties. There were no orderlies, and the only domestic help consisted of one girl for each ward. These girls were often very young, and it was not unusual for them to arrive on duty late and already tired, having spent the previous night in an air raid shelter.

A circumstance which caused the nurses some concern was that surface mail from Australia often took as long as five months to arrive, and at times did not reach England at all, having been mistakenly directed to the Middle East.

The nurses' health in England was good. Upper respiratory tract infections were the greatest cause of invalidism, these being aggravated perhaps by the absence of adequate ventilation during the long blackout hours of winter. The average number of nurses in hospital was 3.5 per day.

Late in 1940 it was decided to transfer most of the Australian troops in England to the Middle East, and the hospital also. The first group of members of the A.A.N.S. under Sister Bowe left Godalming on 12th November and the main party under Matron Butler on 18th March. The nurses in the main party had an eventful departure. Their port of embarkation was Glasgow, and for two days before their arrival and for six

days after that city suffered some of the worst air raids of its experience. When they arrived in the Middle East the 2/3rd A.G.H. nurses with other medical people were transferred to various Australian hospitals in Palestine, and the 2/3rd A.G.H., although retained on paper on the Order of Battle, did not work again as an active unit.

When Italy entered the war Palestine, up to that time a training ground for operations on the Western Front, became itself a potential battle-ground. In September Italian forces invaded Egypt and advanced as far as Sidi Barrani. There they were halted by British troops and, in December, driven back to Bardia, which was strongly fortified. The 6th Australian Division was brought forward to attack Bardia and, supported by British artillery and armour, early in January succeeded in capturing it. The Australians pressed on to Tobruk, and by the 22nd this too had fallen. Hoping to capture the remaining Italian forces in Cyrenaica, British and Australian forces advanced westward; Benghazi fell without opposition on the 6th February.

The 2/2nd A.G.H. and the 2/1st and 2/2nd C.C.S's were the first medical units with nurses attached to follow the 6th Division from Palestine to Egypt. The 2/2nd A.G.H. nurses under Matron Sage had arrived at Gaza Ridge in May 1940, but their hospital did not begin to function until it moved to Kantara in December. In the meantime, its nurses were attached to various British hospitals in Palestine and Egypt. At Kantara the unit was set up entirely under canvas in a desolate sandy place, close to the Suez Canal, and early in the New Year the first ambulance convoys began to arrive, mostly men wounded at Bardia. The hospital could not offer them many comforts; the food was poor and the tented wards, set in the loose sand of the desert, seemed to have only an uncertain tenure. The building of hutted wards and accommodation for the staff was got under way—and only just in time, for one evening during a particularly violent sandstorm the tents could no longer be restrained, and all the patients had to be hurriedly moved to the not quite completed huts.

The 2/1st C.C.S. nurses under Sister M. J. Hanna had reached the Middle East in the second convoy, and were fostered by the 2/1st A.G.H. The unit set up a camp hospital at Gaza, and, when this closed after about a fortnight, they moved to Qastina, where the unit again acted as a camp hospital. Late in 1940 the C.C.S. was transferred to Amiriya, a few miles from Alexandria. There ward accommodation was in tents, which, like the nurses' tents, were dug in as a protection against the air raids. The cold was intense, particularly at night, and even on duty the nurses had to wear greatcoats and Balaclavas. On one occasion torrential rain flooded the wards and sleeping quarters; patients were moved to tents hastily erected above ground, and bedpans and other equipment, which were submerged, could not be located for days.

On New Year's Eve the unit moved by train to Mersa Matruh, arriving there at 11 p.m. in pitch darkness. It was impossible to unload any gear

until daylight, and the nurses camped in barracks for the night. Next morning they were allotted quarters in a building which was partitioned to the ceiling with sandbags. The British had sent back their own nurses, and almost as soon as the Australian nurses arrived the British Command ordered their withdrawal. However, Lieut-Colonel J. K. Adey, the commanding officer of the unit, insisted that they were needed, and eventually permission was given for them to remain, provided they were moved to safer quarters. These were about half a mile from the hospital in an underground regimental aid post, which had been built but not used as a British C.C.S., and was then part of the defence line surrounding the area. It consisted of three tunnels with concrete walls, converging in an area 25 feet below ground level, which contained a 500-gallon water tank, a kitchen with store, an operating theatre and three wards to take stretchers slung on the walls. Air was supplied by vents, but during dust storms dust flowed down instead of air. Bugs and fleas abounded. To get to and from the hospital the nurses had to pass through a minefield. This led to a harrowing experience for two of them when they were allotted a new driver who lost his way when well inside the minefield. They emerged safely after their driver turned round and followed his vehicle's tyre marks through the sand to the entrance.

The hospital was established in the lower floors of a well-built barracks. The first wounded to come in were from Salum and the escarpment beyond. The nurses worked straight shifts of 12 hours, and more when the rush of casualties increased. Italian prisoners, previously attached to an Italian hospital, were allocated to the unit, and their help was welcomed. When Bardia was taken and its harbour made safe for shipping, wounded were evacuated direct to Alexandria; work at the C.C.S. slackened and the nurses returned to Alexandria.

This was the first C.C.S. to operate in forward areas. It was now highly mobile, its nursing staff being able to unpack the unit in approximately three hours and to pack it in slightly less. This ability was to be tested to the utmost in the months to follow.

The 2/2nd C.C.S. nurses under Sister V. Paterson had moved to Amiriya in December. The unit did not operate there, and the nurses' work was confined to instructing the medical orderlies. Like the nurses of their sister C.C.S., they lived in tents in the desert under conditions of great discomfort, their nerves on edge from the constant dust storms and with insufficient washing facilities. Riding, their only relaxation, was a doubtful joy as the desert was pitted with slit trenches. At the beginning of January 1941 they left Amiriya for Alexandria, but without the men of the unit who went forward to Tobruk.

Another general hospital, the 2/4th, arrived in Egypt at the beginning of 1941. Its nurses, under Matron G. Thomas, were at first attached to the 2/2nd A.G.H. at Kantara. After the fall of Benghazi they were called forward to Tobruk, and travelling in a British hospital ship, arrived safely on 27th March. They were lucky to escape an unpleasant adventure. The men of the unit went on ahead in the notoriously unseaworthy *Knight*

of Malta: bad weather was encountered and the vessel was shipwrecked. All aboard managed to reach land, but only after many trials. It had been intended that five nurses should go too, but by a happy accident they had been left behind at Alexandria.

Nurses of the 2/2nd C.C.S. also joined their unit at Tobruk, bringing the total of nurses there to 63. All were housed at the Albergo, a hotel which normally accommodated eight people. Some Italian prisoners were sent along to do the cleaning, but they really preferred to sing, much to the annoyance of the nurses who had been on duty during the night and who wanted to sleep. The hospital was some distance away in what had been an Italian barracks. The walls of the wards were scarred with shrapnel and bullet marks, and the nurses had to clean away a quantity of rubbish before the beds could be set up. Water was brought from Alexandria, and was therefore scarce, and there was little linen. In this forward area blackout regulations were strictly enforced, and if a light showed, a shot was fired and questions asked afterwards; there was still danger from booby traps left behind by the retreating enemy, and an armed escort marched the nurses to and from the hospital. Casualties began to flow in even before the hospital was ready, and soon the nurses had forgotten about such things as days off; they worked until they had to sleep, and then started again.

After the fall of Benghazi the British advance westward slowed to a halt, and at the end of March a German counter-offensive began. The 9th Australian Division, which had replaced the 6th in Cyrenaica, withdrew to Tobruk, where some of the troops were destined to undergo an eight months' siege. Although the great value of the nurses' services was appreciated, it was decided, in view of the instability of the military position, that they must leave. Much against their will they were evacuated in the British hospital ship, *Vita,* on 8th April. On board they were allotted to wards and during the voyage were kept occupied, looking after the wounded. On arrival at Haifa, they were sent on to the 2/1st A.G.H. at Gaza.

By this time the 2/2nd A.G.H. at Kantara was very busy, and after a short period at Gaza the 2/4th A.G.H. and 2/2nd C.C.S. nurses were sent there. The hospital was in a target area, and there were frequent air raids; walking wounded, who were in a nervous condition as the result of previous bombings, were apt to take off into the desert during a raid and the sister-in-charge of the ward would have some difficulty in collecting them when it was over.

The nurses spent a good deal of their time off duty at the Y.W.C.A. recreation centre in Ismailia, but they had no respite from air raids there. The Y.W.C.A. building was on a corner, and the buildings on the other three corners had all been hit by bombs. It was in Ismailia that the 2/4th A.G.H. nurses suffered their first losses. A car in which Matron Thomas and two nurses were returning to hospital during a blackout was involved in a head-on collision with another vehicle; Matron Thomas and one of the nurses was killed and the other seriously injured.

In October 1940 Italy had invaded Greece through Albania, and it seemed likely that Germany would eventually give military support to her ally. Fears of German intervention in the Balkans were realised, and on 5th March a strong British Commonwealth force began to sail for Greece, where R.A.F. and other units were already established. Included in the force was the 6th Australian Division, which had been recalled from Cyrenaica for the purpose: its medical holding units were the 2/5th and 2/6th A.G.H's and the 2/3rd C.C.S.

Nurses of the 2/6th A.G.H. under Matron J. S. Abbott, and of the 2/3rd C.C.S. under Sister F. J. Deane, arrived in Greece on 3rd April, and those of the 2/5th A.G.H. under Matron K. A. L. Best nine days later. The first arrivals were billeted in Athens, and the later ones at Ekali, just outside the city.

The Australian nurses would have liked to explore Athens, but they were to have few opportunities. On 6th April German aircraft attacked Piraeus; an ammunition ship blew up, setting other ships alight and severely damaging the docks. The nurses of the 2/6th A.G.H. had been instructed to join their unit at Volos, but the instruction was cancelled and they went to work in a British R.A.P. near the docks. These were the target for continuing air attacks, which gained in ferocity, and after a week the nurses were withdrawn to Kephissia. A British hospital was operating there, and casualties were pouring in, but an offer of help from the Australians was not immediately accepted.

Meanwhile the C.C.S. nurses had joined their unit at Elasson. Their arrival seemed opportune as casualties had begun to come in and more were expected, but on 9th April it was decided that the unit was sited too far forward for their safety, and they were withdrawn to the 1st New Zealand General Hospital near Pharsala. Here in an Arcadian setting war seemed far away; on the surrounding hills shepherds tended their flocks, and the only road into the town was a donkey track behind the hospital. However, almost immediately the Allied military position began to deteriorate. The nurses at Pharsala were ordered back to Athens, and they left on the 15th April, arriving on the same evening.

With resistance collapsing everywhere before the German thrust the decision was made on the 21st to evacuate Greece. Brigadier D. T. M. Large, the D.D.M.S., British Troops in Greece, considered that the 26th British General Hospital and the 2/5th A.G.H. with their nursing staffs should remain to look after seriously ill men and those sick and wounded who would come in later, but the D.M.S. of the A.I.F., Major-General S. R. Burston, refused to agree to any Australian or New Zealand nurses being left. On the 20th the hospital ship, *Aba,* arrived at Piraeus, and nurses of the 2/6th A.G.H. were ordered to embark. When Matron Abbott and 24 nurses had gone on board there was an air raid, and the remainder had to return to their old quarters at Kephissia. That night they at last received a request for help from the British hospital. It was now so crowded that it was difficult to move between the beds. As well as British, Australian and Greek patients, there were Italians and a handful of

Germans. The care of the last-named was allotted to the Australian nurses, but after they had been at the hospital for only three days orders came for them to leave.

When Burston arrived in Alexandria he emphasised to Major-General P. S. Tomlinson, Director of Medical Services at Middle East Headquarters, that the Australian Government wished all the Australian and New Zealand nurses to be taken off. Brigadier Large still thought that some should stay, not only in the interests of the men to be left behind but because embarkation at such a late stage would involve hardship and danger. The navy shared this view. They feared that a hospital ship might now be sunk, and suggested, if the nurses had to be taken off, that a destroyer be used. The nurses themselves were willing to stay, but before he left for Egypt General Blamey, commanding the Anzac Corps, gave instructions that all were to be evacuated.

On the 23rd one half of the 2/5th nurses and all the masseuses set out from Ekali in charge of Sister J. L. Cook. They were joined by the remaining 31 nurses and masseuses of the 2/6th A.G.H. from Kephissia under Sister H. B. McAlpine, and by some British and New Zealand nurses. Their destination was Navplion.

Bomb craters, dead horses and donkeys, and vehicles filled with Greek refugees blocked the road, and progress was slow. This was disturbing because the British were going to blow up the Corinth Canal, which they had to cross. They managed to get to the canal in time and were almost in Argos when enemy aircraft appeared. They machine-gunned the convoy, and one of the trucks carrying nineteen of the New Zealand nurses overturned, slightly injuring four of them. Everyone took cover, some in a barley field and others in a cemetery, where they remained during the day while the planes kept up the attack. When darkness fell they resumed their journey. Fortunately the night was moonless, and there were no more air raids. At Navplion they were to be taken off in a destroyer. The navy would not allow trucks to approach too close to the harbour for fear of attracting enemy attention, and while the convoy was still a few miles away the nurses were ordered to get out, to throw away their surplus baggage, and to refrain from talking or smoking as they made the last part of their journey on foot. At Navplion they were taken on board Greek caiques; all around them ships were burning, but they reached the destroyer *Voyager,* and sailors, who had been hauling on board a succession of men in tin hats and khaki greatcoats, were astonished to find that the tin-hatted, khaki-clad figures now being helped over the side were women—so astonished that they dropped the first one into the water: fortunately, she was rescued unharmed. The nurses were desperately tired and, despite their strange surroundings, most of them were asleep when *Voyager* left at 1 a.m. Towards noon on that day Stukas appeared. Some of the nurses took cover in the galley as the cook was leaving to go to his battle station, and he charged them light-heartedly to "Keep an eye on the peas, girls". The air attack was abortive, and *Voyager* reached Crete without any further adventures.

The remaining nurses—40 from the 2/5th A.G.H. under Matron Best and 40 from the 26th Hospital—were ordered to leave on the 25th. The Australians after a last silent meal with the officers of the unit set out at 8 p.m. They were able to take with them only such personal belongings as could be stuffed into a haversack and the letters, watches and other tokens entrusted to them by the men who were staying, and which they promised to pass on to families back in Australia. They were driven in trucks to a beach near Megara, arriving about 1.15 a.m. When their eyes became accustomed to the darkness they saw about them a sea of waiting men. After more than an hour on the beach they were taken in small boats to the *Thurland Castle,* whose crew gave them the few cabins on board. The *Thurland Castle* was heavily bombed, but all the nurses reached Crete safely on the 26th.

In the beginning medical conditions on Crete were unavoidably chaotic. Some of the nurses of the 2/6th A.G.H. went on duty on the night of their arrival. They admitted walking wounded to their sleeping tent and themselves slept in the open.

Matron E. C. Mackay of the 1st New Zealand General Hospital was placed in charge of the British, Australian and New Zealand nurses in Crete. The Australians and New Zealanders were attached temporarily to the 7th British Hospital whose own nurses were still in Egypt. Air raids were frequent, and the nurses had to seek concealment in the crops and under the olive trees.

Greece had shown the folly of postponing the evacuation of nurses from endangered areas, and it was decided to take them all from Crete in a convoy which was to leave Suda Bay on the 29th April. H.M.A.S. *Voyager* took off some; others, who embarked in the *Corinthia,* had the task during the voyage of looking after the many civilians on board, mostly women and children; a small Greek ship, the *Ionia,* took off the remaining 200. The three ships were subjected to repeated air attacks, but all the nurses reached Egypt unharmed.

Most of the casualties from Greece and Crete were received at the 2/11th A.G.H. in Alexandria, which acted as an advanced casualty clearing station, transferring its patients as soon as they could be moved to the 2/2nd A.G.H. at Kantara. The 2/11th A.G.H. had been established at the end of 1940. Some of the nurses of the 2/3rd A.G.H., lately arrived in the Middle East from England, were transferred to its war establishment, and Miss E. J. Bowe became Matron. When Matron Butler and the rest of the nurses of the 2/3rd A.G.H. arrived in the Middle East in April 1941 they also joined the 2/11th A.G.H., and Matron Bowe returned to the 2/2nd A.G.H., with which she had served when she first arrived from England.

The 2/11th A.G.H. was situated in a modern building owned by the Greek Government, who lent the A.I.F. a 200-bed wing. The area, however, was unsafe with the railway on one side, a gasometer on another, and a water tank on a third. The nurses with other medical people were

housed in the main building, which did not have any air-raid shelters. During the first week in June it was decided that it was unwise to keep all of them in one building at night, and arrangements were made for the day staff to be taken out each night to the 2/9th A.G.H. at Amiriya and returned to Alexandria in the early morning. Travelling 25 miles each way to and from Amiriya, working hard during the day, and then having to spend part of the night sheltering in slit trenches, was a severe test of endurance. Fortunately, after about four weeks the army was able to provide a comfortable house for them in Alexandria about a mile and a half from the hospital. They lived there for the next five months.

Many of the casualties from Tobruk were also treated at the 2/11th A.G.H. Convoys arrived at Alexandria about twice a week, except during the full moon when it was considered unsafe for the ships to carry wounded. If the Australian hospital had already admitted to capacity, wounded would be taken to one of the British hospitals. It was always possible, however, that they would be looked after there by Australian nurses. When the war began many Australian nurses who were in England had volunteered to join the Q.A.I.M.N.S., and they had worked in that service on hospital ships and ambulance trains, in casualty clearing stations and in field and base hospitals. After Dunkirk many were transferred to British hospitals in the Middle East, where they had the opportunity of nursing Australian soldiers for the first time.

Australian troops were withdrawn from Tobruk between August and December 1941. On 22nd November the 2/11th A.G.H. was transferred to Palestine, its nurses being attached to the 2/1st A.G.H. during the staging period.

When the men of the 2/4th A.G.H. came out of Tobruk the nurses of the unit, who had been detached to the 2/2nd A.G.H. at Kantara, were overjoyed to learn that their own hospital was to be set up again, this time at Jerusalem. The hospital was housed in the former German and Italian hospitals, the surgical ward being in one and the medical ward in the other. The nurses' quarters were stone houses just outside the wall of the old city and overlooking the Garden of Gethsemane. The patients were mostly British and not so numerous as to prevent the nurses from appreciating the country. On Christmas Eve many of them attended the service at Bethlehem, and returned to the hospital after a heavy snow fall which made the city more than ever like a biblical picture. Early in the New Year they learned that they were to leave for an unknown destination.

On their return from Greece most of the nurses of the 2/5th and 2/6th A.G.H's were attached for duty to other hospitals in the Gaza Ridge area. The exceptions were some from the 2/5th, who accompanied part of their unit to Eritrea. There was a need for hospital accommodation in the Middle East remote from the danger zone of Palestine and the Canal, and it was thought that Eritrea would be suitable.

While waiting near Suez to embark for Eritrea the nurses lived under very primitive conditions. They messed with a British hospital, but lived

in a shed in the desert: it had no washing or toilet facilities, and some of them suffered from dysentery. Their situation improved when a truck was provided to take them into Suez, where they could swim and have baths at the French Club. Air attacks on Suez were frequent and the town had one of its heaviest raids just before they sailed. From Suez they travelled to Massawa, which they found had been heavily bombed by the R.A.F., so that their ship had difficulty in avoiding the wrecks which littered the harbour. After a further train and bus journey they arrived near Asmara, where they were billeted on an Italian aerodrome. Here they were very comfortable. However, it was found that the long journey to Eritrea was exhausting to wounded men, and only one convoy was brought down in the four and a half months they were there. Just before they left for home one sister was killed in a motor accident near the hospital.

Because of the possibility of large-scale German infiltration of pro-Vichy Syria and the consequent threat to Egypt it was decided that a combined British-Free French drive should be made into Syria. The invasion force, which included the 7th Australian Division, began to advance on 7th June 1941, and five weeks later, on 12th July, the campaign was over. Though comparatively short, it had been an arduous one.

Nurses were not sent to Syria during the fighting, but treated casualties at the casualty clearing stations and hospitals in Palestine to which they were evacuated—at the 2/1st C.C.S. at Nazareth, the 2/1st A.G.H. at Gaza and the 2/7th A.G.H. at Kafr Balu. The capacity of these units was strained to the utmost. The 2/1st C.C.S. had been set up in portion of the monastery known as "Terra Sancta". Convoys were received late at night and even the corridors were crowded with patients. The nurses under Sister Hanna had most of them ready for further evacuation next morning, although many of the very ill had to be retained. The 2/1st A.G.H., a 1,200-bed hospital, increased its beds unofficially to 2,200, but the nursing staff under Matron Fall was not increased until August 1941 when about 50 nursing reinforcements arrived from Australia, most of whom were posted to the 2/1st A.G.H. The 2/7th A.G.H., whose matron was Miss E. F. Johns, was not properly established when the campaign began, but on alternate nights ambulances from each of the hospitals met the hospital train from Syria, and somehow the staffs managed to cope.

After the armistice, nurses were brought up to the 2/3rd C.C.S., which had opened in a school in Beirut, and to the 2/1st C.C.S., which was to operate in a mental hospital at Asfurieh between Beirut and Aley. Sister S. E. Deane was the Sister-in-Charge of the 2/3rd C.C.S. The 2/1st nurses under Sister Hanna and some of the orderlies preceded the rest of the unit to Syria. They had with them equipment for only 50 patients but on the first day admitted over 150, so that much hard work was necessary before everyone could be made comfortable. Their patients were a polyglot collection—Australians, British, members of the Foreign Legion

—and sometimes it was a brawl which brought them to hospital. Before the units left Syria Sister D. A. Vines took over from Sister Deane and Sister D. M. Clinch from Sister Hanna.

Nurses were also attached to the hospitals run by the 2/1st Field Ambulance at Zebedani, the 2/2nd Field Ambulance at Homs, the 2/4th Field Ambulance at Tripoli and the 2/8th Field Ambulance at Aleppo. In August another general hospital, the 2/9th, was brought up to Nazareth to provide hospital service closer to Syria. The unit took over the monastery which had been vacated by the 2/1st C.C.S. Since arriving in the Middle East the nurses of this unit and their matron, Miss N. M. Marshall, had not seen as much as they would have wished of hospital work in forward areas. The unit had arrived in Egypt in March 1941, and set up a small hospital at Abd el Kader, a desolate spot in the desert. They were overjoyed when they learned that they were going to Greece, but with the collapse of the Greek campaign, they were sent instead to Nazareth.

Meanwhile in the Western Desert the German *Africa Corps,* having taken Tobruk, advanced to El Alamein. The 9th Division was withdrawn from Syria, where it had relieved the 7th Division, and by 5th July 1942 was encamped at Amiriya for attachment to the Eighth Army. Units of the 9th Division took part in the many attacks and counter-attacks which were a prelude to the break-through of the German line at El Alamein, which was achieved in November.

During the action at Tel el Eisa, which preceded El Alamein, the 2/7th A.G.H., with its nurses attached, moved up to Buseili, and the nurses of the 2/3rd C.C.S., still under Sister Vines, came up to rejoin the men of the unit just before the battle of El Alamein. The C.C.S., with four wards and a theatre, all under canvas and sunk well into trenches in the sand, was outside a walled Arab village, Burg-el-Arab, about half-way between Alamein and Alexandria. In the neighbourhood were a British and a New Zealand C.C.S. The nurses knew that there was going to be a big battle, and on 23rd October went to bed early so as to be ready to receive the first patients, who were expected to arrive at noon on the 24th. Actually they started to arrive before breakfast, and they continued to come in, the C.C.S. giving them treatment and evacuating them as quickly as possible to make room for more. The nurses worked day and night for almost 48 hours.

After the break-through at El Alamein the enemy retreated westward pursued by British forces. The nurses of the 2/3rd C.C.S. with nurses from the New Zealand C.C.S. moved on towards Mersa Matruh in a convoy which stretched along the desert road as far as the eye could see. The marching men were surprised as well as cheered to see women in the ambulance. The C.C.S. was set up about 12 miles outside of Mersa Matruh, and at this time was in advance of the Australian forces. Sick Italian and German prisoners, who had been left behind when their armies withdrew, were admitted. Some of the male members of the unit went

into Mersa Matruh to work in a hospital there, but the nurses were not allowed to do so because of the fear of typhoid, and men who were seriously ill or who needed surgery were brought out to the C.C.S.

In addition to their nursing duties, members of the A.A.N.S. in the Middle East acted as instructors in nursing procedures. During 1941 four tutor sisters were appointed to the A.A.M.C. Training Battalion for male orderlies in Palestine: four model wards were erected and equipped for them, and each sister was able to give independent tuition. Another five sisters were attached to the special temporary training school for medical orderlies at Gaza Ridge. During the occupation of Syria nurses were also attached to the 2/1st, the 2/8th and the 2/11th Field Ambulances to assist in training male orderlies.

In the Middle East the A.A.N.S. worked under very varied conditions —in a workhouse in Nazareth, an Italian and German hospital at Jerusalem, the Kaiser's Palace on Mount Scopus, underground at Tobruk, in an Egyptian barracks at Mersa Matruh, a marble and brick edifice at Alexandria, on an aerodrome in Eritrea, in stone houses in Syria, and in tented wards in many places. Their living quarters were often primitive: in some cases four nurses shared an E.P.I.P. tent and at Mersa Matruh they lived in an underground shelter infested with bugs. Climatic conditions varied from the dry heat and dust storms of the desert, through the semi-tropical humid atmosphere of the Nile Valley, to the winter cold of Palestine and Syria.

The Matron-in-Chief, Miss Sage, considered that their melange uniform was too hot for the Middle East, and in the middle of 1941 a uniform with Norfolk jacket and skirt made of grey cesarine was approved. Later this was changed to a grey cotton dress, buttoned to the waist, with a gored skirt.

At a matrons' conference in August 1941 it was recommended that the A.A.N.S. should be granted the rank and not merely the status of officers and that instead of stripes they should wear the appropriate stars and crowns on their epaulettes as did male officers and officers of other women's services. However, nothing was done to put this recommendation into effect until 1943.

When Major-General R. M. Downes inspected the medical services in the Middle East in 1941 he reported very favourably on the A.A.N.S. "Their morale, efficiency, appearance and reputation," he said, "were all on a high grade."

Malaya: Two brigades of the 8th Division under Major-General H. Gordon Bennett arrived in Malaya in 1941. The medical holding units of this force were the 2/4th C.C.S., and the 2/10th and the 2/13th A.G.H's. The first body of nurses arrived in February. Those of the 2/10th A.G.H. under Matron O. D. Paschke went to Malacca, where the unit had been allotted part of the civil hospital. The nurses of the C.C.S. went with their unit to Kajang, moving to Johore Bahru in September and in the next month to Kluang. The 2/13th A.G.H. arrived in Septem-

ber, and for six weeks was housed at St Patrick's School on Singapore Island. Matron I. M. Drummond, formerly of the C.C.S., was then transferred to the unit which moved into part of a mental hospital at Tampoi, seven miles from Johore Bahru. Sister K. Kinsella became Sister-in-Charge of the 2/4th C.C.S.[1]

The conditions enjoyed by the nurses in those early days did not foreshadow events to come. Nurses stationed at Malacca, when on leave, could visit Kuala Lumpur or travel to Singapore by air-conditioned train. Nurses in the Singapore area suffered from the enervating climate, but the city had compensating attractions—its beautiful white bungalows set against the vivid green foliage of the hillsides, the native bazaars and the hospitality of the European residents who entertained them at dances and sampan picnics. They were made honorary members of the European clubs, and could play tennis and golf, or swim in a tiled pool surrounded by little tables under brightly coloured beach umbrellas. Major-General Downes, who visited Malaya in the middle of 1941, not unnaturally found that their conditions were good. Their only cause for complaint, he thought, was that their allowance for clothing and equipment—£40 supplemented by £10 from the Australian Red Cross and Comforts Fund—was inadequate. He also urged that they be issued as quickly as possible with the open-necked dress which had been designed for the tropics.

The scene changed quickly in December. On the 8th Singapore was attacked from the air, and in the following weeks there was the hardly-credible spectacle of British forces retiring from one position to another before the Japanese.

The site of the 2/10th A.G.H. at Malacca became untenable, and a new site was sought on Singapore Island by Colonel J. Glyn White and Matron Paschke. As there was no building available large enough to take the whole hospital the medical section was established at Oldham Hall, a former school for boys, and the surgical section at Manor House which had once been a boarding house. While the unit was moving, some of its nurses were detached to the 2/13th A.G.H. and others to the 2/4th C.C.S. at Kluang. Those at Kluang lived in planters' bungalows among the rubber. There were air raids daily, from which the nurses sheltered in trenches. Big convoys of badly wounded men were continually arriving and the medical officers worked for days and nights without sleep. On 15th January all its nurses rejoined the 2/10th on the island. Conditions for nursing were difficult and all water had to be carried. Soon casualties began to arrive at such a rate that bungalows near by had to be commandeered to house the overflow.

The 2/13th A.G.H. also had to move to Singapore Island. The move was accomplished in 38 hours without one patient missing a dose of medicine. The site selected was the unit's former home, St Patrick's School. Some time before this the C.C.S. had fallen back from Kluang to Mengkibol, and now this unit too had to move on to the island. Its

[1] The following narrative is based on statements, letters and interviews with surviving nurses, and on Betty Jeffrey, *White Coolies* (1954) and Jessie Elizabeth Simons, *While History Passed* (1954).

first site was the Bukit Panjang English School: when this came within range of Japanese artillery the unit was moved to the Swiss Rifle Club. On 19th January Colonel A. P. Derham, A.D.M.S. of the 8th Division, ordered that nurses of the C.C.S. should be evacuated to the 2/13th A.G.H. but the hospitals themselves were now in danger: the 2/13th on the coast had been hit by a bomb, and the 2/10th, although within the perimeter, had been shelled and two members of the staff killed. By 1st February most of the British troops had crossed to Singapore Island, and the engineers blew up the Causeway. This gave the nurses a feeling of security, but only briefly. On the night of the 8th the Japanese landed on the island. The C.C.S. and hospitals were now operating under almost insuperable difficulties. There were continual air raids, the municipal water-supply was threatened as the Japanese advanced towards the reservoirs, and water gushed from mains broken by Japanese bombardment; at night there was a complete blackout, which meant that nearly all the hospital work had to be done in the dark. Heavy casualties were pouring in straight from the battlefield: and in the wards there was so much overcrowding that men were lying on mattresses, closely packed together on the floor, while others had to be left on the lawns until room could be found inside.

On the 20th and 30th January Colonel Derham had recommended to General Bennett that the nurses be evacuated. Bennett refused on both occasions because of the effect such a move would have on civilian morale. However, Derham instructed Glyn White to send as many nurses as he could with casualties leaving Singapore, and on 10th February six members of the A.A.N.S. embarked on the hospital ship *Wah Sui* with wounded men of the A.I.F. The nurses themselves all wished to stay when they realised there was no hope of other hospital ships arriving to take away their patients, but on the 11th half the nurses from each hospital and all the physiotherapists were ordered to leave. They were driven to the docks through smoke-filled streets, past blazing buildings and wrecked and abandoned cars among which telegraph wires trailed lifelessly. At the docks they had a long wait. Air raids were now continuous, for the enemy was concentrating on this target, but when the nurses finally boarded the *Empire Star* no one had been injured. A member of the Royal Navy who had observed them waiting at the dockside noted that after each raid they attended to the wounded, and he paid tribute to their bearing and courage. The next day the remaining 65 nurses were instructed to meet at St Andrews Cathedral. Because of the destruction near the waterfront they had to leave their vehicles and walk the last few miles to their ship. This was the *Vyner Brooke,* which sailed on the 12th. Three days later Singapore capitulated.

The *Wah Sui* had been used at Alexandria as an anchored convalescent ship for officers. In the present emergency she was hurriedly fitted for sea, and painted white with a red cross on the side. A retired captain was put in command. With 350 people on board, lying in the hold and all over the deck, many of them seriously wounded, she moved into mid-harbour.

Bombers attacked but did not cause any damage. The Japanese signalled that the ship would be bombed again if she stayed, and on the 12th she departed. Enemy aircraft followed, flying low overhead but did not attack. Despite the danger, the ship had to anchor at night, as the boilers could not stand the strain of operating for 24 hours. During the passage three of the wounded died but the rest reached Batavia safely. The nurses disembarked and later sailed for Australia in the *Orcades*.

The *Empire Star* suffered more severely. It was a cargo ship with accommodation for only 16 passengers: on this trip it carried 2,154. The nurses were quartered in the hold. Waves of bombers attacked them soon after leaving Singapore. One was brought down by Lewis gun fire, but the ship received three direct hits. Many of the men on deck were killed or wounded, and Sisters M. I. Anderson and V. A. Torney of the 2/13th A.G.H. came up from the hold to attend to them.[2] The *Empire Star* managed to reach Batavia. Some necessary repairs were carried out there, after which it carried on to Australia without further adventures.

The *Vyner Brooke,* which took off the last of the nurses, carried 300 people, mostly women and children. The nurses slept on the decks. They had very little to eat, and no washing facilities. Matron Paschke warned them that the outlook was black, and those who were not able to swim were allotted to lifeboats. The progress of the *Vyner Brooke* was slow; during the day the vessel hid among islands, at night making a dash for the open sea, where it steamed full speed ahead. On Saturday, 14th February, it was discovered by Japanese aircraft. Despite desperate zigzagging, it received several direct hits, and the order was given to abandon ship. Most of the lifeboats had been holed by machine-gun fire, and only two got away safely. These held the oldest people and the wounded. The nurses, two of whom had been wounded by flying splinters, saw that all civilians were off before they themselves took to the water.

Sisters W. E. F. Oram, C. J. Ashton and M. M. Wilton had clambered into a lifeboat which was full of women and children, but the *Vyner Brooke* was sinking so fast that it threatened to tilt over on top of them, and they had to jump out and swim hard to get clear. Rafts, kitbags and all kinds of luggage fell overboard, and at this stage Sister Wilton disappeared and was presumably drowned. Sister Oram was hit on the head by one of the falling rafts, but she managed to reach another raft, where she was joined by a civilian woman. They saw all around them other survivors clinging to lifeboats, rafts or whatever wreckage they had been able to grasp. The *Vyner Brooke* had gone down in Banka Strait off the south-eastern coast of Sumatra, and Sister Oram and the civilian woman spent the afternoon and night trying to row to the shore. When day broke they found themselves surrounded by Japanese in motor boats, none of whom offered to pick them up. They reached the shore under their own power at 6 a.m., and landed near the Customs House at Muntok, which was the Japanese headquarters. They were the first prisoners the Japanese had taken on Sumatra, and as such were objects of

[2] They were awarded the George Medal and the MBE respectively for their courage.

considerable interest. They were searched—an easy task as they were nearly naked—and questioned. When they explained that their ship had been sunk by Japanese planes and that they had had to swim the Japanese broke into gales of laughter. Soon afterwards more prisoners began to stream in and before long the limited space was overcrowded. There was no food, and not even water until an Englishwoman persuaded the Japanese to let her collect a bucketful; then a glass of water was handed around and everyone took a sip. Out of their own ration of rice, the Japanese gave each prisoner about five grains.

Night came and they lay down on the bricks to sleep. In the morning they discovered that the Japanese had segregated the men and women. The women remained at the Customs House during the next day without food and with only a few sips of water; the one toilet was overflowing and the place was becoming foul. At 5 p.m. the Japanese marched everyone across the road to the cinema, which was already full of people. In the morning they were each given a plate of rice, and, being unaccustomed to eating with their fingers, they used nail files and scissors or anything they could find which was suitable for conveying food to the mouth. A hole, dug just outside the door, with a transparent screen draped around it, served as a toilet. Each person went outside for a few minutes, and then the doors were shut and barred and no one was allowed out for any reason whatsoever. All spent a miserable night sitting up. Morning came, but no food, and later in the day the prisoners were marched to the coolie gaol.

The two lifeboats from the *Vyner Brooke* managed to reach Radji Beach, where their occupants were joined by other survivors who had swum or drifted ashore, including Matron Drummond and 21 of the nurses. They lit a fire and, while the nurses tended the wounded, the chief officer of the *Vyner Brooke* sent a party to the nearest native village to ask for help. The natives were uncooperative and the chief officer then called everyone together; he told them that the island was in Japanese hands, and asked them what they wanted to do. All voted for surrender. Meanwhile, another lifeboat had drifted in containing about 25 English soldiers whose ship had been sunk on the Sunday night. The next morning the chief officer set off by himself for Muntok. No one had eaten for days, and while he was gone the civilian women and children became restless. To take their minds off their troubles Matron Drummond organised them into a party and they followed the chief officer into the town. They met him coming back with the Japanese and were told to wait, but, becoming impatient, they continued into Muntok. When the Japanese arrived at the beach they separated the men from the nurses; the men were taken up the beach and bayoneted; the nurses were ordered to walk into the sea. When they had gone a little way into the water the Japanese machine-gunned them, killing all but one, Sister Vivian Bullwinkel, who was shot above the hip. When she regained consciousness she was lying on the beach. She managed to creep into the jungle, where she remained sleeping for long intervals. After two days she realised that

she had a terrible thirst and struggled down to the beach to get water. There she discovered an Englishman, one of the party who had been bayoneted by the Japanese. Sister Bullwinkel looked after his wounds as best she could, but he was in a serious condition having also been wounded before landing on the beach. Three times she went into the native village to beg food for him. On each occasion the village men refused, telling her that she should give herself up, but always when she reached the outskirts native women stole out and pressed rice and fish upon her. She and the Englishman were convinced that the Japanese were not taking prisoners, but, as there seemed no hope for them otherwise, they decided, after ten days, to give themselves up. They realised, however, that, as witnesses of the horror on the beach, their position was particularly dangerous, and they determined to say merely that they had been shipwrecked. On their way into Muntok they met a naval officer in a jeep who drove them to the naval barracks. The Japanese without harming them further sent them to the coolie gaol in Muntok.

Two nurses, W. M. Davis and J. P. Gunther, joined a raft which already held Sister J. E. Simons, a Eurasian radio operator, and two British sailors, one of whom was badly burnt. There was barely room on the raft for four, and those who could took turns swimming and holding on by ropes. Later three civilian women were carried up; one who was unconscious drifted away and was not seen again; the others, a mother and daughter, joined the party swimming and resting on the raft. They saw the fire of the party on the beach, but the currents would not allow them to approach. During the night the burnt sailor slipped off the raft, and the others were too weak to drag him back. Once they hailed a dark shape which loomed up, to find with terror that it was a ship carrying Japanese landing craft destined, as they learned later, for the invasion of Sumatra. From then on they wove in and out of the Japanese invasion fleet. Eventually one of the Japanese ships took the women on board and towed the raft to shore. On the beach the Japs debated the prisoners' fate. Having decided against execution, they gave them a drink and a little food and at night confined them in a pig pen. The next day they were taken to Muntok and imprisoned in the cinema and later in the coolie gaol.

Another party which boarded a raft was not so fortunate. It included two Malay sailors, some civilian women, Matron Paschke and Sisters A. B. Jeffrey, I. Harper, A. M. Trennery, G. M. McDonald, M. H. M. Dorsch, M. D. Clarke and C. M. Ennis, the last named with two small children in her care. They too saw the fire on the beach and the Japanese invasion barges. They paddled all night, and several times came near the shore but each time were carried out again by the strong currents. When day came they were as far from land as when the *Vyner Brooke* went down. Realising that the raft was too heavy, the Malays and Sisters Jeffrey and Harper left it to swim alongside. All were making good progress when a current caught the raft and carried it out to sea. It was not seen again. Sisters Jeffrey and Harper continued to swim towards the

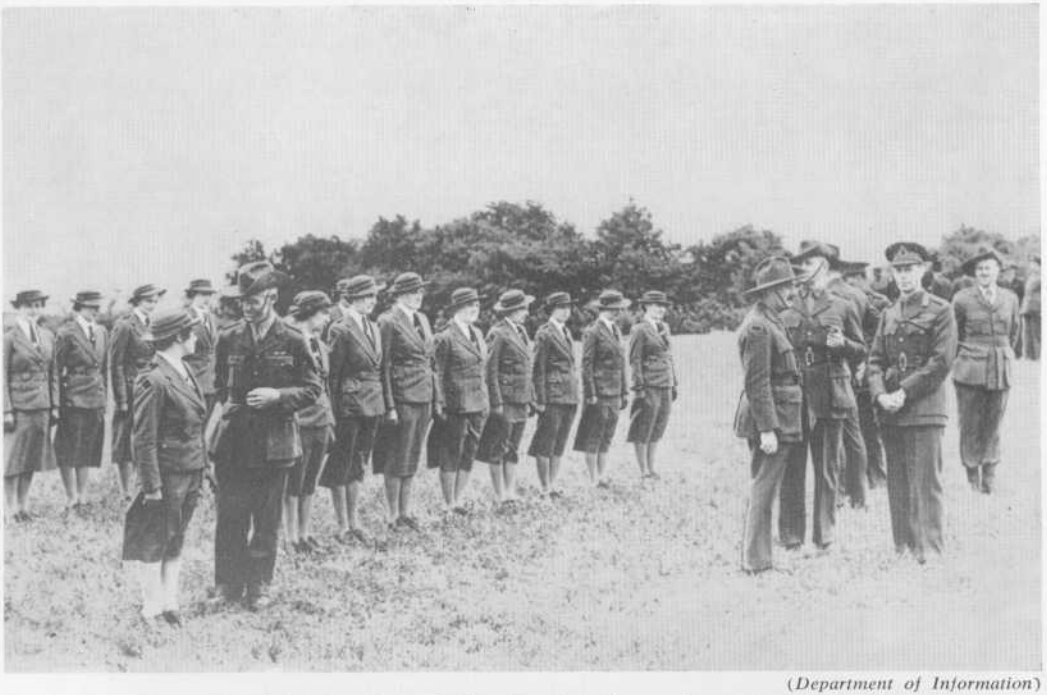


An Australian nurse in the indoor uniform of the 1914-18 War.



(Australian War Memorial)

An Australian Army nurse in the indoor uniform of the 1939-45 War.



(*Department of Information*)

King George VI with Brigadier L. J. Morshead during an inspection of the Australian nurses in England. The officer on the left is talking to Sister E. J. Bowe.



(*E. J. Bowe*)

Inspection of a hospital ward of the 2/1st A.G.H. at Gaza Ridge, February 1941, during the visit of the Australian Prime Minister to the Middle East. *Left to right*: Lieut-General Sir Thomas Blamey, Matron C. A. Fall, Mr R. G. Menzies, Matron G. M. Wilson, Matron-in-Chief, and Lieut-Colonel J. K. Adey, commanding the 2/1st.



A ward of the 2/10th A.G.H. at Malacca, 1941.



A tented ward of the 2/9th A.G.H., Port Moresby, 1943.



(Australian War Memorial)

Colonel A. M. Sage, Matron-in-Chief Australian Army Nursing Service, followed by Matron M. E. Hurley, during a tour of inspection of the 2/1st A.G.H. at Port Moresby, 20th February 1944



(E. J. Bowe)

Sisters A. M. Ayrton, J. M. Doran, W. H. Drylie, F. M. Petrich and D. A. Burnett reorganising the operating theatre of the 2/5th A.G.H. at Morotai, 4th May 1945.

shore. The current had taken them past the beach, and they landed in a mangrove swamp. After swimming up and down creeks they were found by Malay fishermen and taken to their village: they had been in the water for 72 hours. The Malays persuaded them to surrender, and they too were taken to the coolie gaol in Muntok.

Prisoners of the Japanese: Thirty-two A.A.N.S. had survived from the *Vyner Brooke*. They were suffering from exhaustion, severe sunburn and from abrasions, particularly of the chin and armpits where their lifebelts had rubbed. Nevertheless, in a small part of the gaol which had been set aside as a casualty room and hospital, they did dressings and took turns at looking after the wounded and sick, including many with dysentery. The sick, like everyone else, slept on a long sloping cement platform; there were hardly any drugs; the supply of food was small, and each person was rationed to one mug of water a day. Sanitary conditions were appalling. The death rate was high, but all the nurses survived, and after two weeks they were embarked in an overcrowded freighter for Palembang.

When they arrived they were driven through the streets in an open lorry to the accompaniment of jeers from some of the natives, to which the nurses responded with spirit. At first they were housed in a native school and then in two houses, in one of which they were delighted to find an electric stove. Dutch people not yet interned brought them a little food, toothbrushes and other necessities, and their rations were increased. This relatively carefree period ended when they were moved next door so that the houses they vacated could be turned into a Japanese officers' club. All the A.A.N.S. were ordered to attend the opening night, which they did, leaving only the sick behind. Ill-nourished and dressed in rags, their appearance was not attractive, and they contrived to make it even less so. With hair plastered down, no make-up, and wearing men's boots, sandshoes or with bare feet 27 of them set out to entertain six Japanese officers. The latter were nonplussed both by their appearance and numbers, and during the evening the nurses were able to keep their advantage. They densely refused to understand their hosts' laborious English, refused an offer of powder and lipstick, and insisted that they drank only milk. In one of the houses the Japanese quickly became bored and sent the girls home. In the other house they kept four of the girls and sent the rest home. The four who stayed were threatened with starvation and death unless they became more agreeable. They held out, and, after one of them simulated a T.B. cough, they were allowed to go home. Weeks of fear followed until a Dutch doctor managed to get word of their plight to Japanese headquarters. The club project was then abandoned.

On 1st April 1942 the nurses were transferred to a camp called Irenelaan, where they were told to "nanti nanti"—wait. They waited for 17 months. There were 300 women at Irenelaan and they shared ten three-roomed bungalows, 30 women on an average being crowded into each bungalow. They slept on bare tiled floors, without nets, among hordes of mosquitoes. The sanitary system was primitive and needed

careful supervision. During the early days in the camp food was adequate in quantity but not in quality. It consisted mostly of weevily rice, with occasionally a few decayed vegetables thrown in. On a predominantly starch diet some of the nurses actually put on weight, but they were not getting enough proteins, vitamins or minerals, and deficiency diseases began to appear. Diet supplements could be purchased on the native black market by those who had the money, and the nurses began to look around for a way of acquiring a little. They found it in making such items as mah-jongg sets, hats from native grass bags, and food products from soya beans, which the Japs supplied but most of the internees found indigestible. Buying on the black market was resorted to only with reluctance because of the severe punishments meted out to any natives who were detected. Later the Japanese capriciously changed their attitude, and allowed a weekly shop to be set up in the camp. Firewood was another problem. At first the Japs supplied none and the few sticks of furniture in the houses were quickly used for the purpose, and, when these were gone, doors and other parts of the structure were torn down.

The Japanese subjected the women to many petty annoyances. Sometimes when they were asleep a guard would poke his torch through the open window and flash it on and off until they were all awake. They also suffered from the Japanese fondness for *tenko*—counting. They would suddenly have to stop whatever they were doing and stand for hours, perhaps in the sun or rain, waiting to be counted.

There were English, Australian, Dutch and Eurasian people in the camp—the Dutch had at last been interned. A few of the women, particularly those who had been in the East for a long time, were still unable to grasp how desperate their situation was. They kept saying brightly: "The Japs are bound to send us out soon; we were just due for leave. No white woman ever stays in the tropics for more than three years." But most of them were realistic, and they set about organising the camp in a commonsense manner. Each house elected a captain to act as spokesman, and various committees were set up—sanitary, rationing, nursing and entertaining. Education was carried on by means of discussion groups.

There was a hospital in Palembang run by some Dutch nuns. The Camp Commandant, Dr McDowell, persuaded a Japanese doctor to provide a weekly ambulance to bring the worst cases and those needing dental treatment to the hospital. This provided an underground contact with men imprisoned in Palembang gaol. Husbands and wives met at the hospital, and patients acted as letter carriers. If caught, they were severely beaten but still the practice went on. The Palembang servicemen, who were given small money payments by the Japanese for work performed, made a generous allowance of 75 cents a week to each destitute person in the women's camp. They also arranged to chop wood for the women, for when the Japanese did supply wood it came in large chunks. In the wood the men would conceal personal messages, and news items picked up on a secret radio.

In September 1943 the women received a message by means of the wood supply that they and the men were to be moved. They hurriedly stripped their old camp of everything useful. They found that the move was only a short distance to what had been the men's camp. It was situated in a low-lying, damp and unhealthy position and was in a filthy condition, purposely left so by the men who did not know who their successors would be.

Accommodation was in atap-roofed huts, which were airless, but when there was a storm rain easily penetrated the roof. Water was severely limited. There were three wells, which were almost empty, and one tap from which water only trickled and which usually had a queue of 100 women. Mostly the nurses had to carry water for long distances, not only for themselves but for the Japanese, and for the gardens which they were forced to cultivate.

In April 1944 the administration of the camp changed from civil to military control. The new commandant was a Captain Siki. Under him the small food ration became progressively less; the nurses no longer received any income from the men, and, although they redoubled their efforts to earn a little money—making hats, cooking for other internees and sewing—they were always hungry. In this condition they had to do hard manual labour, unloading heavy sacks of rice from lorries and, worst of all, cultivating the gardens. Slight or imaginary offences were punished by face slapping or by a period of standing in the sun. It seemed that their fortunes were changing when Siki announced that each of them was to be paid 4 guilders 50 cents a month—about two shillings a week—enough to allow them to supplement their food ration. The payments, however, soon ceased. At this stage they were given injections for typhoid, dysentery and cholera, and these undoubtedly saved many lives.

At the beginning of their captivity the nurses had listened hopefully to rumours that they were to be repatriated, or that the Japanese were losing the war. After more than two years in Japanese prison camps they no longer believed such stories, but in August 1944 their optimism revived when a near-by oil refinery was bombed by Allied aircraft. In the same month the first mail arrived from home, and in October American Red Cross parcels arrived. After the Japanese had taken what they wanted from the parcels the nurses received some cigarettes, chocolate, powdered milk, sugar, soup powders, jam, meat, salmon, cheese, coffee essence and butter, but in such minute quantities that the general picture of malnutrition was not much changed.

In October they were moved back to Muntok on Banka Island. The trip was a nightmare. They travelled in three parties in boats which were hopelessly overcrowded. Although diarrhoea was prevalent, there were no sanitary arrangements, except a bucket. The only food they had was a few fried rice cakes, small pieces of pork and some tea, all prepared before the journey. Some of the nurses, in addition to handling their own baggage, had to move heavy trunks belonging to Indonesian internees.

When their efforts slackened Japanese guards slashed at their legs with swords.

The camp at Muntok was new and clean, and close to the men's camp, which was in the coolie gaol the nurses had originally occupied. The men sent quantities of food to welcome them. Seven hundred women were in the camp, which was in a malarious area. The only water-supply came from wells usually dry, which were just a few feet away from the lavatory pits. The Australians here worked both as hospital and "district" nurses. Many of them also entered the hospital as patients—the accumulated result of almost three years' starvation, malaria, beri beri and dysentery. They also suffered from an epidemic which swept the camp; the symptoms were high temperature, periods of unconsciousness and skin affection and it was named "Banka Fever".

The 32 nurses who had survived the sinking of the *Vyner Brooke* were still together, but in February 1945 Sister W. R. Raymont of the 2/4th C.C.S. died. In the next three months three more sisters died—I. A. Singleton of the 2/10th A.G.H., P. B. Hempsted of the 2/13th A.G.H. and D. S. Gardam of the 2/4th C.C.S.

In April 1945 the nurses were told that they were to leave Muntok and return to Sumatra. Weak as they were, they had to load the stretcher cases on to lorries and unload them again at the wharf. Here they were left in the hot sun: one Dutch woman died and had to be brought back to the camp for burial. Conditions aboard ship were appalling both for those suffocating in the hold and those on deck who were exposed alternately to glaring sun and rain. They had very little water, and no food apart from greasy rice cakes they had brought with them; there were no sanitary arrangements. During the voyage eight more people died, and, as there were no weights, their bodies when dropped overboard floated alongside the ship, providing a macabre escort. At Palembang they were herded into a train and after a 30 hours' journey reached their destination—a camp on a rubber estate which had been subjected to the scorched earth policy and was in a highly malarious area. The only comfort was the proximity of the civilian men's camp. The nurses were housed in atap huts with leaky roofs. Sweet potatoes and other vegetables with palm oil for cooking were added to their diet, but the rice ration was reduced. Their impaired digestion could not cope with the change, and they suffered from bouts of indigestion. Starvation, always close at hand, had now to be kept at bay by strange expedients. They ate grass, young fern fronds, and on one occasion a monkey. Most of them had now lost two or three stone in weight.

In May another of the nurses—Sister G. L. Hughes of the 2/13th A.G.H.—died as did Sister W. M. Davis of the 2/10th A.G.H. in July. Sisters R. D. Freeman and P. B. Mittelheuser, also of the 2/10th, died in August, the month in which the war with Japan ended. Although fighting ceased on 15th August, the nurses did not hear of it until the 24th. Siki then made a short speech: "Now there is peace, and we will

all soon be leaving Sumatra. If we have made any mistakes in the past, we hope you will forgive us and now we will be friends."

Male internees from the neighbouring camp came over. Husbands and wives were reunited. The men, in better physical condition than the women, carried water, chopped wood, shot some wild pigs and took over the cooking. Siki threw open the Japanese stores. The nurses ransacked the stores for clothing, and what they could not wear they exchanged with the natives for food. Two Dutch paratroopers arrived at the camp a few days after the peace announcement, bringing messages to the A.A.N.S. from the prisoners at Palembang, and on 15th September they were told that they were to be evacuated. Hayden Leonard of the Australian Broadcasting Commission and Pilot Officer Ken Brown, who had been searching Sumatra for them for three weeks, found them and escorted them to Lahat, where Matron Sage flew in to welcome them. They were then taken by air to Singapore, where they spent a few weeks recuperating before sailing for Australia by the hospital ship *Manunda*.

Despite nearly four years of privation, medical examination indicated that all of them had a good chance of recovering completely.

Rabaul: In March 1941 an A.I.F. force had been sent to garrison Rabaul. The medical party included a detachment of the 2/10th Field Ambulance, which was joined later in the month by six nurses. They were Sisters K. I. A. Parker, M. J. Anderson, D. C. Keast, L. M. Whyte, M. C. Cullen and E. M. Callaghan.

The situation which met them at Rabaul was one often to be repeated. The medical orderlies regarded them as intruders, and for three weeks they were told that there was nothing for them to do at the hospital, but when they did begin to work the orderlies were quickly won over by their friendliness and efficiency. The patients, who had endured the well-intentioned but sometimes ungentle ministrations of the orderlies, were of course delighted to see them.

The hospital had been set up in tents. When the volcano Matupi began to erupt in July scoriae and dust fell over the hospital area. Several other sites were tried, and in December Government House, which had been vacated by the Administrator, was taken over for the purpose.

It was realised that if Japan attacked, the small garrison at Rabaul could offer little effective resistance. Japan's intentions were not to be long in doubt. On 4th January enemy aircraft raided the two airfields. There were more air raids on the 20th and on the 22nd, and the hospital decided to send the walking patients back to their units, and to withdraw the rest to the Roman Catholic Mission at Kokopo. On their way to Kokopo they were machine-gunned by Japanese planes. That night Sisters Parker and Callaghan and an orderly went out to find a shovel to dig slit trenches round the hospital. When they were near the road they suddenly heard Japanese voices, and a truck full of soldiers passed by only a few yards away. They were not detected, and made their way quickly back to the hospital. Early next morning the two medical officers set off along one of the escape routes which had been planned for the force. All

the medical orderlies went with them, except two, Corporals L. Hudson and M. Langdon.[3] There were more than 100 patients in the hospital with more coming in, and the nurses would have refused to leave them unless ordered to do so. However, the possibility of evacuating the nurses does not seem to have been considered, although there was an opportunity to do so when the last R.A.A.F. aircraft was sent out with wounded on the 22nd.

The Japanese arrived at the hospital at about 11 a.m. Padre John May went out to meet them carrying a white handkerchief. The Japanese did not seem disposed to accept the surrender, and the nurses were lined up, and machine-guns trained on them. After a period of suspense the Japanese announced: "You will not be shot today." After that they inspected the hospital. Many of the patients had rifles hidden under their bed covers, but at the nurses' request they put them on the floor. About every fifth man was taken outside and the nurses did not see them again.

The six women now set about the task of keeping the hospital running. There were hardly any drugs and no food, and they managed to feed their patients only after they had broken into the Burns Philp store and found a quantity of food which they hid in the hospital. After a week the Japanese became organised. All drugs and food had to be surrendered, and the nurses were told that they might continue to look after their patients if they bowed to every Japanese they met. Sisters Keast and Anderson, who did not bow sufficiently low to a Japanese officer, were brought back and made to bow several times as a punishment. Hoping to improve their status with their rank-conscious captors, Sister Parker when questioned said that she was a captain and the other nurses lieutenants. Thereafter the Japanese called her "Tai". She thought they were saying "Kay", her name, which puzzled her because it sounded so friendly.

But the friendliness of the Japanese was almost as alarming as their ferocity. They issued pressing invitations to the nurses to come and live in the Japanese officers' club at Rabaul, invitations which were politely refused. The nurses, with four Methodist missionaries and the civilian nurses, lived at the Dutch Convent where the nuns had given them refuge. At first they slept downstairs. On the night after the Japanese arrived Sister Callaghan awoke to find that a Japanese had forced a window and had his bayonet pressed against her cheek. She called out, and when one of the other nurses switched on the light he went away. Thereafter they lived in dread of these nocturnal visits. The nuns moved them upstairs to the sacristy, but this proved no deterrent. At all hours of the night there would be loud bangings at their door. They always opened quickly pausing only to put on their red cross armbands. The Japanese would saunter in, lie down on the beds and demand that someone play the piano for them. The Seventh Day Adventist Minister, thinking to give them some protection, came and slept outside their room, but he was

[3] Both were later killed by the Japanese.

soon taken away. The attentions of the Japanese ceased suddenly with the arrival of a boatload of Geisha girls.

Not all the Japanese were formidable. Some of them were only fourteen years old. When they left Japan they had believed they were going on a cruise, and they were now homesick and frightened. The nurses comforted them, and Sister Whyte taught a few of them to knit.

A crisis occurred in July. The Japanese said messages were being sent out of Rabaul, and they suspected the nurses. They were brought out into the blazing sun, and for the second time machine-guns were trained on them, but again they were not harmed. A few days later on 5th July they were taken into Rabaul and put aboard the *Naruto Maru* for Japan. With the nurses were the Methodist missionaries, one civilian woman, the civilian nurses and the Australian officers.

Accommodation and hygiene facilities on the *Naruto Maru* were no worse than those usually provided by the Japanese for their sea-going prisoners. When they disembarked at Yokohama the nurses were separated from the other prisoners and taken to the Bund Hotel. In the dining room a gleaming array of cutlery was set before each place, but the food which materialised was not on a par with the excellence of the cutlery. After six weeks at the Bund they were transferred to the Yokohama Yacht Club. For some reason the Japanese now regarded them with more than ordinary suspicion, and, in addition to their usual guards, a woman gaoler, formerly the matron of a home for delinquents, was detailed to watch them. With tongue in cheek they called her Mama San. Some weeks after their arrival they heard Australian voices in the room below. As soon as they were able to get Mama San out of the way they eased notches out of the wooden floor and peered through. They found that the voices belonged to the Australian officers with whom they had travelled to Japan, and lively conversations followed.

At Yokohama Sister Parker became ill. The Japanese diagnosed her trouble as appendicitis, and she was taken to the hospital for surgery. The hospital was filthy with unemptied pans under the beds, and the nurses were also filthy. Sister Parker refused to submit to an operation, and she later recovered without benefit of surgery.

At first the nurses were put to work making the little silken bags in which the Japanese kept images of their gods. Later they made envelopes, an occupation with more possibilities. In every packet of 100 envelopes they concealed a note in English and, having discovered that the glue intended for the envelope flaps contained some nourishment, they ate as much as they could digest. The Japanese, finding their employment uneconomic, transferred them to manual labour. They did gardening, dug trenches, cut down trees, swept streets, emptied lavatories, and once they had to pull an ox cart when the ox dropped dead. They received a small and irregular wage, and sometimes they gave money to Mama San to make purchases for them. Food and clothing were unprocurable but she brought them what she said was carbolic tooth powder.

They were still in good spirits. When they heard that the Emperor was coming to Yokohama to review the Sea Scouts they jokingly told their guards that they intended to capture him and tell him their story. They were promptly taken to the police station and kept there for two weeks until the Emperor's visit was over. Strangely enough, the supervision there was not so strict as at the Yacht Club. One of the guards whom they called "Happy" used to sleep while they kept watch for him, and they took this opportunity to steal the gaol curtains to make clothes. They suffered intensely from the cold. When they first arrived in Japan they had each been given four yards of woollen material. This was shoddy stuff, and by now their only clothing was shorts and a singlet made from sheets which the Reverend Mother had given them when they were leaving Rabaul.

After 18 months in Yokohama they learned that they were going to be moved. As there was a repatriation ship in the harbour they leapt to the obvious, happy conclusion, and when they left the Yacht Club did not bother to take their paltry belongings with them. However, their destination was not the ship but a town 30 miles from Yokohama, Totsuka, where they were accommodated in a former tuberculosis hospital.

During the early days of their imprisonment in Japan the food had been adequate but progressively rations were reduced until they were existing on a starvation diet—mostly watery rice to which dogs' entrails were added as an infrequent treat. Determined to keep alive, they stole food whenever they could, although, if caught, the punishment was a beating. At Totsuka, where they worked in the fields, it was easier to steal, and they would conceal pilfered vegetables under their arms, calling this axilla drill. As well as Mama San, they now had another special gaoler, a clerk from the Foreign Office. He was with them almost continuously, but never spoke a word. One of their chores was to take him his meals. Being themselves very hungry, they would proffer the steaming food with somewhat insulting remarks, all of which he received with a blank, uncomprehending stare.

Sister Callaghan contracted tuberculosis at Totsuka. Her friends begged that she be given proper treatment, but this was refused. "More better she die," the Japanese said. They did not, however, force her to work. After four years of captivity the other five nurses were also ill; all of them suffered intermittently from malaria, dysentery and beri beri, and the only drugs available were a little aspirin and quinine. Work was now a torture. When Mama San ordered them to cut down a large camphor tree they were too weak to do so, and pretended not to understand what she wanted. To their horror the Foreign Office clerk interposed in perfect English, "Madam wants you to cut down that tree."

They were still at Totsuka when the war ended. For five days they were kept in ignorance of the fact, but they suspected it from the dispirited mien of the guards. Eventually Sisters Parker, Whyte and a civilian nurse managed to escape from the prison and make their way to the main road. A jeep driven by a Japanese and carrying an American officer and an

enlisted man came by and they stopped it. Although the Japanese driver tried to prevent them speaking to the Americans, they were able to make themselves known, and at last the war was over for them. They heard later that another American had seen them working in the fields a few days before their rescue, and that the Japanese had told him they were English women married to Japanese.

Java and Ceylon: At the beginning of 1942 most of the Australian nurses in the Middle East returned to Australia with the I Australian Corps.

In January the 2/5th and the 2/11th A.G.H's left Suez in the *Mauretania,* and at Bombay trans-shipped to the *City of Paris* and the *Esperance Bay* respectively. The 2/5th's heavy baggage in charge of a medical officer, Captain M. J. McNamara, reached Java in the *Orcades.* Captain McNamara was taken prisoner there, and was drowned when a ship in which he was being transported to a prison camp was torpedoed in the Pacific. The *City of Paris* and the *Esperance Bay* meanwhile were diverted to Ceylon, where the 2/5th's baggage caught up with it. After staying there a week both ships sailed for Australia.

In February the 2/9th A.G.H., with the nurses of the 2/2nd A.G.H., left Suez for Australia, arriving at Port Adelaide in March.

Also in March the 2/6th A.G.H. took over from the 2/1st A.G.H. at Gaza, and the 2/1st nurses under Matron Fall embarked at Tewfik in the *Laconia.* In the same ship were Matron Sage and Sister J. E. Headberry, Matron Sage's assistant. The *Laconia* sailed for Bombay where the nurses were disembarked and distributed between the *Katoomba,* the *Duntroon* and the *Holbrook.* These three ships set course for Colombo, where they found ships in the harbour still burning from a recent air attack, and while they were there the naval base at Trincomalee was bombed. They were not allowed to go ashore and after a few days their ships left for Mombasa. From there they proceeded to Durban, where they saw landing craft preparing for the invasion of Madagascar. They arrived in Australia at the end of May 1942.

Another medical unit included in the movement, the 2/2nd C.C.S., was diverted to Java. Its nurses, travelling in the *Orcades,* disembarked at Tanjong Priok, and were sent to Bandung in the hills inland from Batavia. The six nurses who reached Batavia from Singapore in the *Wah Sui* were also sent to Bandung after helping to evacuate wounded in H.M.I.S. *Kapala.* However, because of the precarious military position they were all returned to Batavia after a short time and on 21st February sailed for Australia in the *Orcades.*

Miss M. J. Hanna had become matron of the 2/4th A.G.H. in November 1941. After leaving the Middle East the unit accompanied two brigades of the 6th Division which were sent to Ceylon. The hospital opened in St Peter's School on 10th May 1942, and the nurses worked there until November, when they returned to Australia.

Another Australian General Hospital, the 2/12th, had been established at Welisara in Ceylon since late in 1941, its nurses arriving in October

1941. The hospital buildings consisted of ten wards, administration and specialists' blocks, plus various messes and living quarters. They were of brick, with the exception of the sleeping quarters which were constructed of palm leaf, and were ideally suited to the tropical climate.

Patients included British troops, Australians of the 6th and 8th Divisions and many naval patients, survivors from the *Prince of Wales, Repulse, Hermes* and *Yarra.* There were also air force casualties from Japanese raids on the island. In January 1942 the first casualties from Malaya were received, and in February 250 more, mostly mothers and children. The last hospital ship to leave Malaya also called at Colombo.

Nurses of the 2/12th gained their first large-scale experience of tropical diseases in Colombo. They nursed cases of scrub typhus, malaria, blackwater fever, dengue and sandfly fever, sprue, dysentery, tropical skin diseases and ulcers, and ankylostomiasis.

One sister who had studied occupational therapy in Australia established this service at the hospital with such success that British hospitals asked for instruction, and one British sister was attached for training.

In their leisure time the nurses played tennis and cricket, swam and surfed. The unit had leased a bungalow at a hill station, 6,200 feet above sea level, where Europeans retreated from the humidity of the coast. The nurses usually spent their leave there, neighbouring tea and rubber planters helping to entertain them.

Apart from air raids, the anticipated attack on Ceylon did not come, and the 2/12th A.G.H. closed late in 1942. Its nurses returned to Australia about the same time as those of the 2/3rd C.C.S. and the 2/6th and 2/7th A.G.H's, who had remained behind with the 9th Division in the Middle East.

In Australia, meanwhile, nurses were serving in base, general, camp and women's hospitals, at casualty clearing stations, convalescent depots, internment camps, on ambulance trains and in medical research and training units. Most of the mainland units in which they served are listed in an appendix to this chapter. Not all these units were static: many were moved to different locations within Australia and some were sent overseas.

In some areas the A.A.N.S. provided a civilian hospital service—in the Northern Territory, in north-western Australia, the Torres Strait area, and even in the southern States. During 1943 a severe outbreak of typhoid fever occurred on the outskirts of Melbourne, and nurses from the army helped to care for those affected. They also nursed German, Italian and Japanese prisoners at various camp hospitals within Australia.

As the war progressed and specialisation increased, the A.A.N.S. began to train its own sisters in specialist departments, in theatre and blood-bank techniques and in facio-maxillary, plastic and orthopaedic work. Some aspects of malaria research were included in their activities, and when a Malaria Research Unit was raised at Land Headquarters in 1943 four and later five nurses were posted to it.

In October 1943 the L.H.Q. Army Women's Administration School was inaugurated, and principal matrons, matrons and sisters engaged on administrative duties attended. Other nurses were trained in all aspects of nutrition at the L.H.Q. Catering School. Working as mobile teams, these nurses visited hospitals in different areas to check on the nutritional aspects of hospital work and to instruct the staffs. In 1944, when the army began to train selected members of the A.A.M.W.S. as nurses, army nurses acted as instructors.

While most of the nurses serving in Australia envied their colleagues who had been given the opportunity to work closer to the battle areas, this did not interfere with the competence or cheerfulness with which they carried out their equally important if sometimes less spectacular roles at home. Of the nurses who remained in Australia further reference must be made to the work of those posted to units in the Northern Territory. A detachment of the 2/5th A.G.H. arrived at Darwin in July 1940 and remained there until the end of the year, when they rejoined their parent unit in the Middle East. However, the strategic importance of Darwin called for the establishment of a full-scale army hospital, and in the middle of 1940 Bagot Compound, previously a hospital for aborigines, was acquired for the purpose. Bagot was opened in December. It provided accommodation for 150, the infectious patients in tents and the rest in hutted wards, and was known as the 19th A.G.H. until April 1941, when the 119th A.G.H., a 1,200-bed hospital, arrived to take its place.

The nurses of the 119th A.G.H. and their matron, Miss E. McQuade White, landed at Darwin on the 22nd April, but because of a strike on the waterfront the unit's equipment was not unloaded for another five weeks. The existing buildings at Bagot were not extensive enough to house the nurses, and until tents could be provided, they lived at the Quarantine Station some miles away. The day after they arrived a melancholy incident occurred. A truck in which a number of them were travelling between the Quarantine Station and the hospital was involved in an accident; a nurse, Sister M. High, was seriously injured, and an immediate operation had to be performed to amputate her right arm.

Bagot was intended only as a temporary site, but even so it was an unhappy choice. In addition to the fact that it was situated between the civil and the R.A.A.F. airfields, a great deal of work was required to make it even habitable. The septic system was faulty; the drains were inadequate and laundering facilities could only be described as primitive. The nurses slept in tents, and their mess was a hut divided by bamboo screens into dining and lounge compartments. They found the heat and insects of the area a bane but once they had become accustomed to them they settled in with their usual adaptability.

A hospital of a more permanent type was planned at Berrimah, nine miles south of Darwin. Berrimah, the aboriginal word for "Make sick fella better", was opened in January 1942. This was a 600-bed hospital. The wards, which were of wood lined with masonite, had cement floors

and were connected by covered ways. The nurses at first shared a mess with the medical officers. The army also took over Kahlin, the new civil hospital.

In the meantime, emergency wings of the 119th A.G.H. had been established at Katherine and Adelaide River, so that at the beginning of 1942 nurses were serving in the Northern Territory at the hospitals at Bagot, Berrimah, Kahlin, Katherine and Adelaide River.

An air raid alert was sounded in Darwin on 11th December. After an hour the "all clear" was given, but a few days later a state of emergency was proclaimed by the Administrator; the digging of slit trenches began, and all civilians were ordered to leave. Further alerts were sounded in the days following, but no Japanese planes appeared. On 18th February the first battle casualties arrived at Bagot. These were eleven men who had been badly wounded while in a convoy bound for Timor which had been turned back by Japanese aircraft.

At 10.5 a.m. the next day the Japanese bombers came. When the alert was sounded patients at Berrimah who were able to walk made their way to the long grass or to the few slit trenches which had been dug. Low-flying planes machine-gunned four of the wards, and one patient too ill to be moved far was killed while sheltering under a bed: a nurse showed great courage in protecting another with her body. The R.A.A.F. hospital was bombed, and ceased to function, its four nurses coming to work for the time being with the 119th A.G.H.

Ships in the harbour suffered most severely. The hospital ship, *Manunda,* which was anchored about a mile from the shore received a direct hit. Twelve of the staff were killed, including one nurse, Sister M. A. de Mestre, and another, Sister L. S. Blow, was seriously injured; other nurses received minor injuries.

Casualties, mainly from the R.A.A.F. airfield, began to arrive at Berrimah at about 11 a.m. and the nurses and physiotherapists worked continuously for 36 hours attending to them. Kahlin was bombed and looted, and on the 20th its patients were transferred to Bagot. Hundreds of cases from bombed ships in the harbour were admitted to the hospitals on shore. Facilities for dealing with them were poor, and on the 20th as many as possible were evacuated to the *Manunda,* which despite its damaged condition was still seaworthy.

It was decided to close Bagot and Berrimah, which were badly situated, and to reopen Kahlin, which, although damaged, was still habitable. A new site was chosen for the 119th A.G.H. on the north side of the Adelaide River, about 70 miles south of Darwin. On the 7th March 22 nurses and 50 patients made the long dusty journey over bad roads from Berrimah to Adelaide River, and a week later the rest of the hospital staff followed. The matron of the 119th wrote:

> The site chosen at Adelaide River was very low-lying with thick bush; sanitary and bathing conditions were shocking, or perhaps I should say non-existent. Much of our equipment had been lost, not due to enemy action, but apparently to

looting. Messing arrangements were very primitive. . . . Laundry was a greater problem than ever before, and a kerosene tin was a great prize to anyone lucky enough to obtain one.[4]

The site too was between a petrol and an ammunition dump, and after about six weeks the hospital was moved again, this time to the south side of the river. There the engineers had built roads and laid water pipes and a 1,200-bed hospital was established. The nurses' lines were about a mile and a half away, and trucks brought them to and from the hospital. Near by was an army farming unit, and the food at the hospital immediately improved. Fruit and vegetables became available and sometimes eggs.

On 23rd October 1942 the hospital at Adelaide River received the first evacuees from the islands in the north, including some nuns who had been hiding in the hills of Timor. All were in a pitiable condition, ill, starving and without proper clothing. Few were able to speak English, and this made their treatment more difficult. Later 45 men from "Sparrow Force", which had been sent to defend Timor, were admitted to the hospital.

Patients from the hospital at Adelaide River were evacuated to Katherine on a hospital train known as "Leaping Lena". Two nurses were included in the medical staff detailed for duty on this train. Instead of the smooth-running carriages with air-conditioning, indirect lighting, sliding doors and chromium-plated appointments of the ideal hospital train, "Lena" consisted of cattle trucks, painted white with red crosses on the roof and sides. The medical officer's truck was at the rear of the train, preceded by that of the nurses. At one end of the nurses' truck there was a 4-berth sleeping compartment with frilled curtains and pretty counterpanes, divided by curtains from a lounge with a tiny shower room in the corner; at the other end of the truck stores and emergency equipment were piled. After the nurses' truck came the first of the four wards, each of which accommodated 16 patients in upper and lower bunks which ran along both sides. The kitchen truck, conveniently situated between the wards, contained a set of kerosene cookers and a kerosene refrigerator, all very allergic to the bumps and jerks of the train. Meal-times were usually made to coincide with a watering hole. The trucks had no windows, only two 6-foot fly-wire apertures at the top and bottom of the bunks, and a single door, something like a stable door. Through this the nurses could watch the country, and it was a red-letter day for them when, after many months, the train was turned around, and they were able to see the country on the other side of the line for the first time. There was no covered way between the carriages, and the nurses became adept at stepping over the gaps between carriages as the train swayed on. Mostly the engines were very old; one nicknamed "Snowdrop" was built in 1865. They would draw the carriages gasping and grunting up inclines on slippery rails, or would career downhill at breakneck speed. If the train was overloaded and the engine could not make the gradient, the crew would try getting up more steam and putting sand on the slippery rails. If this failed, the train was divided and the engine took the first part to

[4] E. McQuade White, *Reminiscences of an Australian Army Nurse* (1954), p. 49.

the nearest loop, and returned for the remainder. Three blasts on the whistle announced that the engine could hold the carriages no longer, and the guard would hasten to apply the brake in the guard's van. One night the carriages broke away from the engine and started to run back down an incline. As the nurses waited for the guard to apply the brake they heard him running alongside the train and shouting for them to open the door. They wasted no time in hauling him aboard, and disaster was averted. Another of "Lena's" unnerving habits was to run off the line. When she did the guard would climb a telegraph pole and tap the wire, and all would have to wait, usually in glaring sunshine, for the arrival of the breakdown gang.[5]

The ambulance train's most memorable journey followed the flooding of the Adelaide River, and the subsequent evacuation to Darwin of the patients of the 119th A.G.H., which was situated on its banks. When the waters had subsided sufficiently the ambulance train took the evacuated patients back to Katherine. The trucks were overcrowded to an unbelievable extent. Men with their helmets and haversacks were lying all over the floor, and heads, arms and legs protruded from the bunks. Through this medley the nurses had to weave their way back and forth during the long 24-hour journey. Psychiatric patients were difficult to handle in the confined space, but with the cooperation of the other patients they were always delivered safely.

There was one casualty. During a Japanese air attack on Darwin a bomb fragment hit the train, which was standing in the station yard, and a young orderly was struck. He later died of his wounds.

As mentioned, army nurses in the Northern Territory, in addition to nursing military personnel and evacuees, also undertook the care of the civilian and native population. Thus the 109th A.G.H., under Matron S. Haines, Principal Matron, Northern Territory, took over the civilian hospital at Alice Springs. As there was no accommodation there for the nurses they slept in tents and messed in a hostel, belonging to the Australian Inland Mission. Both civilians and soldiers were nursed at the hospital. The service to civilians included a midwifery section and a maternity and infant welfare clinic, and clinics were held for school children, among whom a constant watch was kept for trachoma, drastically prevalent in that area.

Night duty in Alice Springs could be rather daunting. It was not unusual for dusky Don Juans to come prowling around the ward where the sick lubras were accommodated. A hair-raising yell usually announced their advent. However quickly the nurses rushed in they were always too late to catch a glimpse of the intruder, and in fact few of them really wanted to.

A 600-bed hospital, the 121st A.G.H., was built at Katherine and camp hospitals were established throughout the Northern Territory, the first at Larrimah, 116 miles south of Darwin. Kahlin became the Fortress camp hospital. In March 1942, when there was a big air raid on Darwin,

[5] Lorna F. Laffer, "Leaping Lena" (in typescript).

there were no nurses at Kahlin, but they returned there in January 1943, and remained during the many raids which followed.

The conditions under which the nurses worked in the Territory, especially in the early days, were extremely difficult. For seven months of the year the country was covered by a fine, red dust, and when the wet season came the dust turned to mud. Most of them lived in tents, which during the "wet" were by no means weatherproof. Heat and humidity were high and fungi grew on clothes and in shoes. Snakes often invaded the wards and living quarters, and insects, particularly flies, were troublesome. Food was poor. There were no organised entertainments or clubs, and at Adelaide River some of the nurses remained in the hospital enclosure for weeks at a time because they had nowhere to go. Yet there were compensations. The country with its flamboyant colour schemes had a strange beauty, and it offered its own distractions. Some of the nurses went buffalo and duck shooting, and others, less energetic, took pleasure in meeting the "characters" of the Territory—such people as the aboriginal whose trachomatous eyes they were treating, who turned out to be the son of a character in the book *We of the Never Never,* or the old cattleman who had been the companion of Lasseter on some of his explorations.

While all members of the A.A.N.S. volunteered for oversea service, at first only those posted to oversea units were given an A.I.F. number and the privilege of wearing the bronze Australia on their epaulettes. This seemed hardly fair, for nurses in the Territory were exposed to enemy attack and, as mentioned, the conditions under which they worked were very difficult. In 1942, however, they were given A.I.F. status.

General conditions of service in the Territory also improved. Roads were built and farms started. At the various hospitals hutted wards and living quarters gradually replaced tents, and at Adelaide River where previously all officers, male and female, had messed together, a separate mess and recreation hut was built for the nurses. A hygiene squad dealt with the menace of flies and other insect pests.

At 4.15 a.m. on 14th May 1943 the hospital ship, *Centaur,* on her way from Sydney to Port Moresby was torpedoed off the Queensland coast, despite the fact that she was fully illuminated and marked with the red cross. She sank in three minutes. There was no time to launch the lifeboats. Of those who managed to get off the burning ship, some were killed in the water by flying metal, some pulled down by suction, and others burnt by the flaming oil which escaped from the ship. Two hundred and sixty-six people lost their lives.

Eleven of the twelve nurses on board were killed, including Matron Anne Jewell. The survivors clambered on to rafts and bits of wreckage which they tied together. Among them was Sister Ellen Savage. She was seriously injured, but she concealed this from her companions; she administered what first aid she could; rationed out the food and water, and by her own courage helped to keep morale high. After 36 hours, during

which sharks swam round the rafts, the survivors were rescued by an American destroyer. Describing her experiences later, Sister Savage wrote:

On 13th May I was allotted to Regimental Aid Post duties with Dr Thelander. That afternoon proved to be very busy with many men from the 2/12th Field Ambulance reporting their minor complaints. We were interrupted in our duties by the ship's siren alerting us to lifeboat drill (that was the fourth for that one day). After being dismissed I dashed to my cabin and, still having many duties to attend to, left my life-belt on the floor at the side of my bed instead of storing it on top of a wardrobe as usual. The reason I mention this is that it was fateful that the life-jacket should be beside me next morning.

The evening on board ship was as usual and we retired about 10 p.m. Early next morning my cabin mate, Merle Moston, and myself were awakened by two terrific explosions and practically thrown out of bed. In that instant the ship was in flames. Sister Moston and I were so shocked we did not even speak, but I registered mentally that it was a torpedo explosion. The next thing Sister King, a very great friend, who was in the next cabin screamed near my door "Savage, out on deck". As we ran together we tied our life-jackets in place. We were so disciplined that we were making for our lifeboat stations when out on deck we ran into Colonel Manson, our commanding officer, in full dress even to his cap and "Mae West" life-jacket, who kindly said, "That's right, girlies, jump for it now." The first words I spoke was to say "Will I have time to go back for my great-coat?" as we were only in our pyjamas. He said "No", and with that climbed the deck and jumped and I followed, hoping that Sister King was doing likewise. There were other people on the deck by then and the ship was commencing to go down. It all happened in three minutes.

I endeavoured to jump as we had been instructed, but the suction was so great I was pulled into the terrific whirlpool with the sinking ship. It would be impossible to describe adequately that ordeal under water as the suction was like a vice, and that is where I sustained my injuries—ribs fractured, fracture of nose and palate by falling debris, ear drums perforated, and multiple bruising. When I was caught in ropes I did not expect to be released. Then all of a sudden I came up to an oily surface with no sign of a ship, and very breathless from this ordeal.

My first contact was with an orderly, Private Tom Malcolm. We exchanged a few gasped sentences and swam to a piece of flotsam which proved to be the roof of one of the deck houses. We balanced our positions and floated on this till about 8 a.m. There were other people swimming around and scrambling on to whatever was available to hang on to; a few rafts had floated off but not one life-boat was launched. . . . I am the only one who survived from the deck where the doctors and sisters were quartered and I never saw Colonel Manson, Sister King or any of the others again. I feel that some would have been concussed in their beds and some would have been endeavouring to dress, but there was no time.

About 8 a.m. we were floating not so far from a raft which was already crowded but those on board unselfishly decided to make room for us, and a brave lad from Western Australia swam with a piece of rope in his mouth and pulled the raft to us; we stepped across and that is when we saw the first shark, as we had floated away from the oily sea surface. During the day we tied up with other rafts and I suppose about 32 of us floated together surrounded by layers of tiger and grey nurse sharks which frequently shook our rafts. We had two badly burnt men with us, one of whom died that night.

During the 34 hours we were adrift we sighted four ships and several aeroplanes. We would get wildly excited, and, as they passed on their way, an air of despondency would descend on the men. It was a long 34 hours, especially the night time, but morale was very high and I shall never forget the qualities that were displayed by our Australian seamen and soldiers. The submarine surfaced during the night and that was a terrifying experience. An R.A.A.F. aeroplane eventually sighted us



Sisters E. M. Thom, E. I. Uren and J. N. W. Freeman of the 2/3rd A.G.H., returning to camp after a bicycle trip in England.



(Australian War Memorial)

Australian Army nurses on a picnic in the Northern Territory.



Members of the A.A.M.W.S., led by Captain J. M. Snelling, march past Lady Gowrie at Victoria Barracks, Paddington, New South Wales, 1943.

and signalled the U.S. destroyer *Mugford,* which picked us up. Meanwhile, the submarine was still within range.

In the course of the war changes were made in the regulations governing conditions of the nursing service. Originally members of the A.A.N.S. were automatically discharged from the service if they married. In 1942 this policy was modified, and some married women were allowed to remain. This proved unsatisfactory, for there were limitations on the employment of married members—they could, for instance, be employed only in base areas and, once married, their interests and loyalties were divided, and their continued presence in a unit could not be relied upon.

Regulations of 1935 had stated that "members of the Australian Army Nursing Service when on active service may become subject to Military Law by operation of *Defence Act* 117A". Although holding officer status, they were not officers; that is, they were on the same footing as accredited correspondents and official representatives of philanthropic bodies. In March 1943 members of the A.A.N.S. became commissioned officers.

Seniority in the Army dated from 1943 for members of the A.A.N.S. and from the date of enlistment for members of other women's services. This led to an anomalous position, as many senior members of the A.A.N.S., who had served in the Middle East, were junior in Army seniority to officers of the other women's services who had enlisted some two years later.

Apart from the question of seniority some of the nurses did not favour the idea of becoming commissioned officers. They felt that hospital was something of a haven to the soldier, a place where he might unburden grievances and worries to a sympathetic female ear, and perhaps go out feeling the better for it. They feared that rank would have an inhibitory effect, causing patients to regard them as officers rather than as nurses. They had, in any case, always been accorded the utmost respect, and they did not think that their influence and authority would be in any way increased by the badge of rank. In the event, the effects of rank on the nurse-patient relationship were probably rather less than anticipated. Officers of the A.A.N.S. were not addressed by their military rank or by the term "Madam" but by the old titles of "Matron" and "Sister", military rank being used only in official documents. Nor did members of the A.A.N.S. give the formal military salute. Instead they came to attention and acknowledged a salute with a bow and a smile as did army nurses of past generations. The following ranks were held:

Matron-in-Chief: Colonel
Principal Matron: Lieut-Colonel
Matron: Major
Senior Sister: Captain
Sister: Lieutenant

In April 1944 a new appointment was approved for matrons in hospitals of 600 beds or more: that of senior matron, with the rank of lieut-colonel,

and in December this appointment and rank were given to the matrons of all hospitals of 600 beds and over.

New Guinea: The original army hospital in Port Moresby was at King's Hollow. Early in 1942 the nurses serving there were sent back to Australia because of the precarious military situation. In May, however, the Japanese invasion fleet aimed at Port Moresby was turned back in the battle of the Coral Sea; the Japanese force which attempted a landing at Milne Bay was decisively repulsed by Australian land and air forces in September, and, in the same month, another Japanese force which was advancing over the ranges towards Moresby was halted at Ioribaiwa.

In this brighter military atmosphere it seemed safe to bring the nurses back to Moresby, and preparations were made for their arrival, the most obvious being the erection of hessian screens around the showers and latrines which were located at vantage points along the roadside. Seventy-two Australian nurses landed from the *Manunda* on the 28th October 1942, and were given an exuberant welcome by the troops, extraordinary numbers of whom managed to find a pretext for crowding into the town.

Four of the nurses under Sister M. L. Dunman went to the 5th C.C.S. and the rest under Matron N. M. Marshall to the 2/9th A.G.H., which was known as "the Seventeen-Mile". Both units at first consisted of tented wards, a few grass-hut wards being added later to the hospital. In tropical downpours the tented wards were liable to flood and, with thick mud underfoot, the nurses found it difficult to move from patient to patient, especially when they were carrying heavy objects such as oxygen cylinders. The grass-hut wards, while picturesque, were the homes of innumerable rats, scorpions and other insects. Much of the cooking had to be done in the open, and tropical showers frequently interrupted operations. Food was either tinned or dehydrated and the latter, cooked in chlorinated water, was at its best uninteresting. Water was heated on Sawyer stoves, and at first there was no refrigeration.

At this time the nurses' appearance was less smart than usual. When the New Guinea campaign began changes were made in the summer uniform, a safari jacket and skirt of grey cotton replacing the grey cotton dress. At the same time a uniform was designed for malarious areas. It consisted of a grey cotton safari jacket, drill slacks, brown boots and gaiters, a khaki slouch hat with the A.A.N.S. band instead of a puggaree, and a grey cotton beret for use in the wards. Many of these items, however, were not immediately available. In the meantime, the nurses wore their Cesarine ward dresses, without white collar and cuffs, during the day, and after 6 p.m. khaki boiler suits, boots and gaiters or, if they preferred, the long-sleeved ward dresses, provided they also wore gaiters. These were of cotton, long, loose and made to fit over the shoes, so affording protection to the legs and ankles against mosquitoes. No new clothing was available for the first three months, a long time in a climate where clothing rotted quickly.

Soon after the nurses arrived there was a heavy influx of casualties, which were distributed between the C.C.S. and the hospital. On 15th

November four more nurses arrived to complete the complement of the C.C.S., and this was fortunate as numbers of severely wounded men from Myola and Kokoda were admitted during the first ten days of November. The commanding officer, Lieut-Colonel T. G. Swinburne, recorded that many lives were saved because of the presence of the nurses in the unit at this time.

In November the nurses for the 2/2nd C.C.S., still under Sister V. Paterson, also arrived. This unit was established on a rubber plantation at Koitaki, the operating theatre in the planter's home and the rest of the unit under canvas. One of the nurses, M. A. Marshall, had a terrifying experience. While she was working in a ward at night a rat ran up the leg of her boiler suit; the patients tried frantically but unavailingly to help her, and it scurried several times round her body before finally jumping out through the neck of her suit. This underlined the necessity for wearing gaiters. Stray cows were less sinister visitors. One wandered into a nurse's tent and breathed into a box of powder on an improvised dressing table and another into the ablution tent, where it tramped tooth brushes and the like into the earth.

On 2nd November the 25th Brigade entered Kokoda, while the 16th pressed on to Oivi. The Australians succeeded in cutting the track at Gorari behind the Japanese, who broke and retreated to their bases at Gona and Sanananda and Buna on the north coast. Each of these strongholds was bitterly defended, and heavy losses were sustained by both sides before the last of them, Sanananda, fell in the third week of January 1943.

Once the coastal campaign began the medical holding units at Moresby could not expand quickly enough to cope with the inflow. The 600-bed 2/9th A.G.H. was expanded first to an 800-bed and later to a 1,200-bed hospital. With admissions sometimes at the rate of 200 a day, even this was not enough, and by Christmas Day 1942 the hospital had 2,000 patients, still with the establishment of A.A.N.S. for a 600-bed hospital. When no more beds were available, men had to be nursed on stretchers under the beds. In addition to the troops, patients included some sick nuns from a mission at Yule Island.

The hospital situation eased at the beginning of 1943 with the establishment of the 46th Camp Hospital and the arrival of the 2/5th A.G.H. The camp hospital was set up under Matron M. M. Mullane at King's Hollow, five or six miles beyond the 2/9th A.G.H. over Hellfire Pass. It was the only hospital in the Moresby area to have the services of native boys. The latter, wearing white ramis with a red cross, did the nurses' laundry and worked in their mess. This was elegantly furnished. It had an iced water fountain, previously to be seen at the Moresby hotel, and odds and ends of lounge furniture rescued from deserted civilian homes. The 2/5th A.G.H. under Matron J. L. Cook was set up near Bootless Inlet, at first in tented and later in hutted wards. Eight months later it was followed by the 2/1st A.G.H., whose nurses under Matron M. E. Hurley worked with the 2/5th A.G.H. until their own hospital had been com-

pleted. They arrived in Moresby on 8th September 1943, the day after a Liberator bomber had crashed into a company of the 2/33rd Battalion which was waiting to emplane for the forward area, and they worked without respite for many hours treating men injured in this tragic accident.

The first months in New Guinea were a strain on the nurses' physical and mental endurance. The work was hard and unremitting, and, when they did get an opportunity for rest, they went to tents which, more often than not, were leaking. On moonlight nights air raids were common, and on one occasion a bomb fell in the hospital area, fortunately without causing any casualties. Apart from swimming and picnics, they had few facilities for relaxation. Later a club was established for them, also a rest camp. The latter, which was at Rouna Falls, was found to be in a scrub typhus area, but only after two nurses and some of the medical staff had contracted the disease. It was then closed.

They were compensated for these hardships, however, by the appreciation of their patients. A medical officer later wrote:

> "The nurses in New Guinea are wonderful" were the opening lines in many a sick boy's letter home and, if anything, this was an understatement. The conditions in the early days were bad enough for men, but were indescribably worse for women. They had arrived at the beginning of the wet season. Properly made paths and drains were few and the mud was ankle-deep, so that they had to wear high gumboots whenever they ventured outside their tents or wards. The terrible rush of work day after day, the rough conditions, the discomfort, the irregular meals and lost sleep all combined to tax their powers of endurance to the utmost, but they fought on and eventually pulled through until they reached the quieter times that followed in a few months.
>
> The effect their presence had on the morale of the patients was unbelievable to those who were not there to see it. No orderly, however gentle, could make our lads well as quickly as these brave girls. The tired sick boys knew that here was someone who would care for them, shoulder their burdens and share their troubles.[7]

The A.A.N.S. also served in the transports which brought troops to New Guinea. Early in 1943 three sea ambulance units were raised for employment on these ships, and two members of the A.A.N.S. were appointed to each unit.

The Japanese, frustrated in their drive against Moresby, in January 1943 dispatched a force to capture the airfield at Wau. The airfield was held but only by reason of the arrival by air of reinforcements who actually landed in the face of small-arms fire. In April operations in the Wau-Salamaua area were assigned to the 3rd Division, and later to the 5th Division which succeeded in capturing Salamaua on the 11th September.

The capture of Salamaua was part of a wider offensive which aimed to expel the Japanese from the whole of the Huon Peninsula from Lae to Madang. On the 16th September Lae fell to converging thrusts from the 9th Division, which had landed on a beach to the east of the town, and from the 7th Division, which had been brought by air to Nadzab. On

[7] Captain B. Robinson, *Record of Service* (1944), pp. 122-3.

the 2nd October Finschhafen also fell, and, after wiping out commanding Japanese positions at Sattelberg the 9th Division continued to advance along the coast. An American force, which by-passed the retreating Japanese, made a landing at Saidor, where it was joined by the Australians in February 1944.

Meanwhile the 7th Division advanced from Nadzab up the Markham and Ramu Valleys and after a bitterly contested action drove the Japanese from the heights of Shaggy Ridge. In April the headquarters of the 11th Division took over direction of these operations from the 7th Division. Its leading troops, accompanied by troops of the 5th Division advancing along the coast, entered Madang on the 24th. Two days later Alexishafen was captured.

Holding units for the Huon Peninsula campaigns were the 2/7th, 2/8th and 2/11th A.G.H's and the 2/2nd, 2/3rd, 106th and 111th C.C.S's. The 2/11th A.G.H. had been established in the Buna Sub-Base Area in July 1943 to act as a transit hospital for casualties from the 7th and 9th Divisions. Nurses, under Matron O. A. Kestel, began to join the unit in September, being flown up from Queensland where they had been stationed since returning from the Middle East in March 1942. They found that because of the danger of air raids the hospital had not been concentrated in one spot: in fact, the wards were so scattered that Miss Kestel had to make her rounds on a bicycle of ancient vintage brought to the area by the Japanese. On an average there were 2,000 men in hospital, and during the first six weeks at Buna none of the nurses had a day off. Convoys of sick and wounded were coming in continuously, mostly from Finschhafen. Many patients had taken two or three days to reach hospital, travelling by barge and plane, and were exhausted. Among them were men with scrub typhus, who were extremely ill and in need of constant nursing.

In November 1943 the 2/8th A.G.H. was set up near by with Miss M. A. Tisdall as matron. For the first weeks all nursing was done by A.A.M.W.S., but in December the unit's nurses arrived. By now the number of hospital admissions in the area was decreasing, but there were still many cases of malaria and skin disease and some scrub typhus.

Conditions were not easy for the nurses in the Buna Sub-Base Area. They suffered to some extent from tropical illness; they worked very hard, and air raids provided a disturbing accompaniment. The presence of an American negro battalion in the area was another menace. The negroes had attacked some of their own nurses, and they made several raids on the quarters of the A.A.N.S., fortunately without success. On the other side of the picture, the nurses had pleasant living quarters and an attractive mess, decorated with tropical ferns and flowers and set in a coconut grove where there had once been an old native village. Concert parties came up to entertain them, and as well as going to the films they could dance and swim. There were also horse races at Soputa. The horses had been left behind by the Japanese, and anyone enterprising enough to acquire one could enter it in the races. The horses thrived on a diet of

dehydrated carrots—which they seemed to enjoy more than the nurses did —kunai grass, army biscuits and rice. At the races the riders wore proper jockey silks, a tote operated, and the crowds were large and cheerful and, unlike other race crowds, not at all captious. Towards the end of the campaign the nurses were able to retreat to a rest station at Popondetta.

A light section of the 2/3rd C.C.S. had provided medical support for the landing at Lae. When this unit moved out it was succeeded by the 106th C.C.S. with its nurses attached. During the last three months of 1943 this C.C.S. bore a heavy burden, the number of its patients at one stage reaching 1,100. In February 1944 when the pace had begun to slacken it was relieved by the 2/7th A.G.H. whose nurses, under Matron E. F. Johns, arrived soon after. This hospital, its wards tented, was situated on the bank of the Busu River. There was no separate native hospital and the nurses also cared for native patients, and on one occasion for a ward full of Sikhs, who had been rescued by the navy from an island where the Japanese had left them to die. At Lae the nurses' quarters and mess were native huts with palm leaf roofs.

After Finschhafen was taken the 2/3rd C.C.S. set up at Simbang. Large numbers of casualties began to come in once the battle for Sattelberg was joined, and the nurses, who had been detached to the 2/1st A.G.H., were very much missed. Early in January the unit moved to Heldsbach, where the 2/2nd C.C.S. was already operating, but without its nurses. The 2/3rd C.C.S. nurses, now under Sister J. M. Langham, rejoined their unit on 22nd January, and in March when the unit left for the mainland joined the relieving C.C.S., the 106th.

The first medical holding unit assigned to Madang, the 111th C.C.S., arrived in June 1944, and next month Sister E. M. Moriarty and its other nurses, who had been detached during the previous twelve months while the unit was serving at Nadzab, also arrived. In August the C.C.S. moved to Alexishafen, being relieved at Madang by the 2/11th A.G.H. The 2/11th nurses after staging at Lae were called forward to Madang on 15th August, and remained there until December, working with the 111th C.C.S. when their own unit closed in September.

After their return to Australia from the Middle East the nurses of this unit had started to give concerts and card parties for the Red Cross, and they continued the practice in New Guinea. At Madang they staged a concert before a large and appreciative audience, the *pièce de résistance* on the program being the ballet *Les Sylphides*. Their efforts succeeded in raising about £4,000.

Meanwhile at Alexishafen nurses of the 111th C.C.S. were kept busy. During the advance along the coast cases of scrub typhus had occurred in alarming numbers, and a building of the old mission had been converted into wards to receive them. Throughout the island campaigns the services of the nurses were particularly valuable where there were large numbers of cases of scrub typhus. Patients with this disease required constant attention, and before the arrival of the nurses in New Guinea a

high percentage had died. Very often a nurse after being on duty all day would continue to work throughout the night, as she knew that the night sister could not give the scrub typhus cases the necessary attention and also perform her normal tasks in the ward. This devotion to duty was repaid by a steep decline in the mortality rate.

Bougainville. Late in 1944 the II Australian Corps was concentrated at Torokina, Bougainville, to release American troops for MacArthur's projected advance on the Philippines. The task of the corps was to attack the Japanese in three sectors, in the central sector which ran from Torokina to the opposite coast, in the north where the Japanese were to be driven into the narrow Bonis Peninsula, and in the south, an area containing rich native gardens and also strong enemy concentrations. By the time the war ended the Australians had made considerable advances on all three fronts.

The holding units assigned to the operations were the 2/1st A.G.H. and the 106th and the 109th C.C.S's. The 2/1st A.G.H. set itself up at Torokina, where its nurses provided some unexpected comforts for their patients. At the instigation of Matron Hurley, the Red Cross flew up 100 fowls, and the nurses regularly distributed eggs to the sick. They were proud of their egg run, and vigilantly guarded their fowls against possible raids. After a struggle they also managed to bring up an ice-cream machine, which provided ice-cream for 600 patients each day.

The nurses tried to solve their laundering problems by teaching the native girls to wash and iron, an ambitious project as none of their pupils had previously seen an electric iron. After a day's tuition the girls would remove their Mother Hubbards and set off into the jungle in their grass skirts, over which they would sometimes tastefully pull a pair of worn-out step-ins, salvaged from the garbage.

The 109th C.C.S. was situated 30 miles south of Torokina at Motupena Point. Its eight nurses under Sister E. I. Uren treated patients—Australian Army, Papuan native infantry and Japanese prisoners of war—who came in ambulance convoys from the field ambulance a few miles up the line. At first the clearing station's only transport link was a motor launch by which its patients were evacuated to the hospital, but later a road was made through the jungle. The sisters' lines were surrounded by a 15-foot barbed wire fence; troops maintained a 24-hour patrol outside, and the sister on night duty always had an armed escort. Once four of the C.C.S. nurses approached even closer to the front line. They travelled by jeep to inspect the field ambulance which was only 2,000 yards from the Hongorai River, where heavy fighting was in progress. A contrasting experience for the C.C.S. nurses was a visit by H.R.H. the Duke of Gloucester.

New Britain. In New Britain American forces had landed at Cape Gloucester and Arawe on the west coast in December 1943. They were relieved by the 5th Australian Division in October 1944. Advancing eastward the Australians made contact with a strong Japanese force at Waita-

volo, and after heavy fighting succeeded in occupying the position in March.

The 105th C.C.S. had landed at Jacquinot Bay in January 1945, and next month its nurses arrived. During March the C.C.S. held as many as 290 patients, many of whom were battle casualties. The 2/8th A.G.H., its nurses now under Matron M. O. Wheeler, opened at Jacquinot Bay in March. By that time, however, the war was drawing to its close, and the work at the hospital was only of a routine nature.

After the first hectic month the nurses enjoyed Jacquinot Bay. Their quarters were good, the climate was agreeable and their work no longer too arduous. A pleasant interlude was the arrival of Gracie Fields who flew in to entertain service people in the area.

After the Japanese capitulated on the 15th August the 105th C.C.S. was sent to Rabaul to take care of the recovered prisoners of war, most of whom were suffering from the effects of Japanese ill-treatment and neglect.

Aitape-Wewak. In April 1944 the Americans made a successful landing at Aitape, and from September to November the 6th Australian Division took over from them in the area. The chief objective of the division was the capture of Wewak, which was to be encompassed by a two-pronged advance, the 17th Brigade clearing the Japanese from positions in the Torricelli-Sepik area, while the 19th and 16th Brigades pressed towards their objective along the coast. Wewak was taken on 11th May; the 19th Brigade continued its eastward advance as far as Brandi Plantation, and then turned southward in the direction of the Prince Alexander Range. In the inland sector the 17th Brigade after expelling the Japanese from successive villages captured Maprik in April and Yamil in the following month. When the Japanese surrendered the two prongs of the advance were separated by only 16 miles.

In November the nurses of the 104th C.C.S. under Sister N. G. Luke landed at Aitape with their unit, which was ready to admit patients by the end of the month. The 2/11th A.G.H. opened on 1st January 1945 and its nurses began to arrive soon afterwards.

During the Aitape-Wewak campaign the nurses both at the hospital and the C.C.S. had to cope with a terrific rush of work. Battle casualties were heavy; there was a high incidence of skin diseases and finally a devastating outbreak of malaria. At the C.C.S. embarrassment was caused by a breakdown in the system of medical air evacuation. This was particularly serious as numbers of psychiatric patients had to be held; there were no proper facilities for dealing with them, and on occasions they represented a physical menace to the nurses.

During December and January there were heavy rains, and the Aitape River rose to a dangerous level. The hospital was situated on one of its banks and the nurses' lines were completely flooded, one nurse awaking to find fishes swimming under her stretcher. The C.C.S. suffered too. It was situated on the flat, and in one ward all the beds were standing in water,

As the Australians advanced towards Wewak the C.C.S. was moved to But. The nurses did not accompany it, and were very much missed. They were detached to the hospital, and did not rejoin their own unit until it had moved to Cape Wom near Wewak.

Morotai and Borneo. As American forces pressed on towards the Philippines and Japan the 7th and 9th Australian Divisions were allotted the task of invading Borneo. The plan of attack involved the capture of three bases, which in addition to their strategic importance, possessed valuable oil refineries. They were Tarakan Island, Brunei Bay-Labuan Island, and Balikpapan. The springboard for the invasion was to be Morotai Island in the Moluccas, which had been occupied by the Americans in September 1944. The Australian landings met with fierce resistance, but when fighting ceased in August 1945 the Japanese defence had collapsed on all three fronts.

The Australian Army Nursing Service's part in the Borneo campaign was played to a great extent at Morotai to which many of the men requiring hospitalisation were evacuated. The medical holding units allocated to the campaign were the 66th Camp Hospital, the 2/4th, 2/5th, 2/6th, 2/9th and 2/12th A.G.H's and the 2/1st, 2/2nd, 2/3rd and 110th C.C.S's.

The 66th Camp Hospital was the first of these units to become operational. The Sister-in-Charge, Sister E. M. Mounsey, and five nurses arrived at Morotai in January 1945, and they were followed in mid-April by the Principal Matron, Advanced L.H.Q., Matron E. J. Bowe and nurses of the 2/5th under Matron Cook and of the 110th C.C.S. under Sister B. M. Millard.

The Tarakan landing took place on 1st May. The nurses of the 110th C.C.S., which supported the landing, were detached to the 2/5th A.G.H. at Morotai, which began to receive casualties of the battle on the 4th. The next day the hospital ship *Wanganella* arrived at Morotai, bringing up the 2/9th A.G.H., whose matron was now Miss H. Croll, and a facio-maxillary and plastic unit whose nurses joined the 2/5th A.G.H., where they were to work. The 2/4th A.G.H. with Miss J. Hanna as matron and the 2/1st and 2/3rd C.C.S's arrived at the same time but these units were only staging at Morotai.

On 10th June simultaneous landings were made at Brunei Bay and Labuan Island. The 2/1st C.C.S. came ashore at Labuan on the day of the landing, and two weeks later its nurses arrived by air from Morotai. Because of the volume of work at the C.C.S. it was a relief when the 2/4th A.G.H. with its nurses arrived at the beginning of July. The hospital opened to receive patients on the 16th. The 2/6th A.G.H. after staging at Morotai also arrived at Labuan in July.

On 1st July the final Borneo landing was made at Balikpapan. The 2/2nd C.C.S. landed on the 7th, and the 2/3rd C.C.S. a week later. The 2/12th A.G.H. arrived on the 14th. Towards the end of the month all the units were joined by their nurses.

The conditions which faced the nurses during the early days on Morotai were difficult. It was the wet season when they arrived, and there were no roads, only slush, underfoot. The whole of the 2/5th A.G.H., apart from the kitchen, was tented. Most of the wards were set up under coconut palms which, although picturesque, did not provide the expected protection from the heat. The operating theatre, with walls formed by hanging up four sheets dipped in disinfectant, was lit by a shadow lamp, and the operating table was set on a few feet of concrete; water for sterilising instruments was heated by primuses. The nurses' tents were erected close to the beach, and because of drainage difficulties were frequently flooded. It was not unusual for them to find, on returning from a day's work in the hospital, that their stretchers were kept out of the water only by jam tins which someone had set under the legs, and some adroitness was then required to remove gumboots and crawl under mosquito nets without tumbling into the water. Uniforms were washed in salt water and, as there were no irons, pressed with books or other heavy objects.

After the first weeks, however, living conditions were improved, and Morotai began to present to them the atmosphere of a typical tropical isle —waving palms, white beaches, and coral gardens among which colourful tropical fish flashed and darted. When the 2/9th A.G.H. arrived it was set up on the harbour side of the peninsula. The site was properly drained, and was more pleasant than that of the 2/5th, although separated from it only by the main road. Special mess halls were built for the nurses of the two hospitals. These were large huts, open at the sides. Baskets filled with ferns and orchids decorated the upright posts supporting the roof, and brightly painted deck chairs added further colour. There was a dance floor in each, and the 2/5th A.G.H. had a piano which they had brought with them from Eritrea. Later an open-air theatre was set up on the beach front.

When Japan surrendered on 15th August the nurses at Morotai and Labuan had the task of caring for returning prisoners of war. Most of these men were in a shocking condition, and required careful nursing to fit them for the long journey home. Nutrition was a problem; special food was flown up, and the diet of the prisoners, after so many years of malnutrition, required careful supervision. Medical investigation of prisoners—dental, X-ray and pathological—was begun on Morotai.

At the end of August 24 nurses from army hospitals at Morotai and Borneo were attached to an American medical corps unit in Manila. They worked for approximately six weeks in R.A.P's in conjunction with the American medical corps, which was responsible for the reception of British troops who had been prisoners of war.

There was some question, particularly during the island campaigns, whether nurses should be included in the war establishments of casualty clearing stations. A problem was created by their detachment, sometimes for long periods, while their units were in forward areas. At a time when action casualties were pouring in the whole burden of nursing in the wards

and in the theatre usually fell on the male orderlies, and, because of the inclusion of nurses in the war establishment, the orderlies were not always sufficiently numerous or sufficiently experienced to cope. When the military position allowed the nurses rejoined their units, and they invariably insisted on maintaining their own high standard of nursing procedure. This caused some resentment among the orderlies who had been getting along to their own satisfaction. For these reasons Lieut-Colonel J. H. Stubbe of the 2/2nd C.C.S. recommended that the war establishment of casualty clearing stations be reorganised to include male personnel only. This was never done because it was realised that the value of the nurses' work far outweighed any inconvenience caused by their temporary detachment, or in isolated cases, by the friction to which their presence gave rise within the units.

Demobilisation began with the cessation of hostilities in Europe, but was very gradual. A prisoner-of-war reception group was established in the south of England to take care of prisoners of war from Europe, and five Australian nurses had been attached to this unit in April 1945. They remained with the unit for about two months.

In Australia it was arranged that all medical units would transfer their patients as rapidly as possible to the base military hospital in each State, these base hospitals to be taken over by the Repatriation Department and staffed by civilians. The department, however, experienced difficulty in finding the necessary staff, and in some States members of the A.A.N.S. carried on until 1949.

Nearly six years of war had made great physical, mental and emotional demands on nurses. After demobilisation some of them were unfit to return to their particular pre-war job and for others any nursing at all was impossible. All nurses were eligible for rehabilitation benefits as prescribed for members of the Women's Services, and special post-graduate courses were provided for them in such subjects as midwifery and infant welfare.

The number of the A.A.N.S. who served between 1939 and 1947 was 3,477. The States contributed to this total as follows:

New South Wales	1,127
Victoria	915
Queensland	552
South Australia	415
Western Australia	340
Tasmania	128

Deaths due to enemy action totalled 53:

Malaya	41
2/1 A.H.S. *Manunda*	1
2/3 A.H.S. *Centaur*	11

Fifty-five members of the Service received decorations and 82 were mentioned in despatches:[8]

[8] In the First World War the total number of nurses who served was 2,692, of whom 2,269 served abroad. Twenty-one died overseas, and 385 were decorated for their services. The decorations received included 1 CBE, 1 OBE, 42 RRC, 138 ARRC and 23 foreign decorations.

M.B.E.	1
R.R.C.	18
A.R.R.C.	29
George Medal	2
Florence Nightingale Medal	2
Bronze Star (USA)	3
M.I.D.	82

In 1948 the title "Royal" was granted to the nursing service in recognition of its work in the two World Wars, and in the same year the army decided to include the Royal Australian Army Nursing Service within its establishment. In 1951 the Service was designated a corps, becoming the Royal Australian Army Nursing Corps.

APPENDIX

Australian Army Medical Units Operating Within Australia

NEW SOUTH WALES

Casualty Clearing Stations
- 7th, Greta
- 11th, Gunnedah

Hospitals

Base (or military)
- 113th, Concord

Camp
- 11th, Cowra
- 12th, Showground, Sydney
- 13th, Dubbo
- 14th, Hay
- 16th, Ingleburn
- 17th, Liverpool
- 18th, Narellan
- 54th, Wagga Wagga
- 68th, Ingleburn
- 72nd, Ingleburn, Bellevue Hill, Wallgrove
- 77th, Tenterfield

General
- 2/5th, Armidale
- 102nd, Tamworth
- 103rd, Baulkham Hills
- 104th, Bathurst
- 114th, Goulburn

Women's
- 3rd, Concord

NORTHERN TERRITORY

Hospitals

Camp
- 42nd, Mataranka
- 45th, Larrimah
- 55th, Tennant Creek
- 65th, Pine Creek

General
101st, Katherine, Northfield, S.A.
107th, Adelaide River, Darley, Vic
109th, Alice Springs
119th, Darwin, Berrimah, Adelaide River
121st, Katherine
129th, Darwin

QUEENSLAND
Casualty Clearing Stations
2nd, Woodford
6th, Haughton Valley, Ipswich
Hospitals
Base
112th, Greenslopes
Camp
1st, Horn Island
2nd, Chermside
3rd, Enoggera
4th, Exhibition Building, Brisbane
5th, Cairns, Stony Creek
6th, Torres Strait
7th, Redbank
8th, Warwick
10th, Cooparoo
22nd, Canungra
47th, Goondiwindi
67th, Warwick
74th, Mount Isa, Whyalla, S.A.
General
2/2nd, Watten Siding, Atherton Tableland
2/4th, Redbank
2/6th, Atherton Tableland
2/11th, Warwick
2/14th, Charters Towers, Townsville
116th, Townsville, Charters Towers, Cairns
117th, Toowoomba
Orthopaedic
1st, Toowoomba, Frankston, Vic
Women's
2nd, Redbank

SOUTH AUSTRALIA
Hospitals
Base
105th, Daws Road
Camp
32nd, Woodside
33rd, Terowie
34th, Loveday
35th, Warradale
52nd, Wayville
59th, Largs Bay
74th, Whyalla, Mount Isa, Qld
General
101st, Northfield, Katherine, N.T.
121st, Northfield, Katherine, N.T.

TASMANIA
- Hospitals
  - Base
    - 111th, Campbell Town
  - Camp
    - 41st, Campbell Town
    - 56th, Cowan, Lytton
    - 80th, Brighton

VICTORIA
- Hospitals
  - Base
    - 115th, Heidelberg
  - Camp
    - 19th, Bendigo
    - 20th, Broadmeadows
    - 21st, Dandenong
    - 23rd, Geelong
    - 26th, Royal Park
    - 27th, Seymour
    - 28th, Tatura, Warranga
    - 29th, Darley
    - 30th, Ballarat
    - 48th, Watsonia
    - 49th, Wangaratta
    - 50th, Balcombe
    - 58th, Queenscliff
    - 62nd, Portsea
    - 73rd, Caulfield, Fishermen's Bend, Ivanhoe
    - 86th, Puckapunyal
  - General
    - 106th, Bonegilla
    - 107th, Darley, Adelaide River, N.T.
    - 108th, Ballarat
  - Orthopaedic
    - 1st, Frankston, Toowoomba, Qld

WESTERN AUSTRALIA
- Casualty Clearing Stations
  - 4th, Moora
  - 8th, Mullewa
- Hospitals
  - Base
    - 110th, Hollywood
  - Camp
    - 37th, Melville
    - 38th, Northam
    - 39th, Rottnest
    - 40th, Narrogin
    - 53rd, Narrogin
    - 60th, Claremont
    - 75th, Claremont
  - General
    - 2/1st, Guildford and Merredin
    - 118th, Northam
    - 125th, Guildford
  - Women's
    - 1st, Claremont

CHAPTER 37

THE AUSTRALIAN ARMY MEDICAL WOMEN'S SERVICE

WHEN the war began the only women's service in existence in any of the three Australian Services was the Army Nursing Service. In the middle of 1941 the Australian Women's Army Service (A.W.A.S.) was formed, and in December 1942 the Australian Army Medical Women's Service (A.A.M.W.S.). Meanwhile, women's services had been established in the navy and air force.

The history of the A.A.M.W.S. begins with the Voluntary Aid Detachments, which had been in existence for many years. Voluntary Aids were trained and organised jointly by the Order of St John and the Australian Red Cross Society. In the First World War they served in medical units in Australia and overseas, and in the period between the wars did much useful work in the civil community.

Because of the manpower situation they had to be called upon again when war broke out in 1939. Almost at once they began to replace men in military hospitals, and in July 1940 the D.G.M.S. pointed out to the Minister for the Army that many of them were working full time, carrying out duties comparable to those of medical orderlies and nurses, but were not receiving any payment. The War Cabinet hesitated to take steps which might discourage voluntary work, and it was not until December 1940 that it was announced, subject to an assurance that men's employment would not be prejudiced, that Voluntary Aids working as privates would be employed and paid as such. On 1st January Miss B. Foll was called up for duty at the camp hospital at the Showground, Sydney, the first full-time Voluntary Aid to be employed in a military hospital on a paid basis. In the same month four Voluntary Aids reported for duty at Heidelberg and in March enrolment began in Queensland for hospitals at Enoggera, Redbank and the Exhibition Grounds. To be acceptable applicants had to be unmarried and without dependants and between 21 and 35 years of age in the case of other ranks, and between 21 and 45 in the case of officers. All were medically examined in accordance with Standing Orders for the A.A.N.S.

The navy and air force also considered drawing upon the pool of trained Voluntary Aids to relieve men in medical units, but eventually these Services made independent arrangements.

Meanwhile, the A.I.F. hospitals established overseas were also beginning to experience manpower difficulties, and the Director of Medical Services estimated that 540 Voluntary Aids distributed over the six hospitals in the Middle East would free 292 males for other duties. At this stage Voluntary Aids could not be employed outside Australia, but General Blamey endorsed the Director of Medical Services' recommendation that they should be sent overseas, and on 27th July approval was given.

By the end of October, 25 per cent of the members allotted to each district for the first draft had been enrolled and arrangements were made for a preliminary month's training before embarkation. Some misunderstanding now arose over rates of pay. The Australian Trained Nurses' Association in New South Wales objected that the rates were comparable with those given to members of the A.A.N.S., but this was not so, for the only comparable rates were those of the V.A.D. officers, who were very few in number. At that time neither members of the A.A.N.S. nor the V.A.D. had army rank, but nurses were all regarded as officers, whereas the majority of the Voluntary Aids were on the level of other ranks. Uncertainty regarding status and pay continued. In October 1941 the Public Service Board inquired whether the Voluntary Aids were to be considered "as serving in the Commonwealth Military Forces". The Secretary for the Army replied that Voluntary Aids serving in Australia were governed by the rules of their own organisation and that it was proposed that they should be enrolled and not enlisted. In fact, the procedures of induction varied in different areas: in some States they were enrolled; in others they were formally enlisted after taking the oath of attestation. The legal implications of this were important, and the graduation of the Voluntary Aids into a fully-fledged army organisation could be foretold. Already it had been announced that Voluntary Aids who served overseas would benefit under the Australian Soldiers' Repatriation Act.

Early in 1940 two Voluntary Aids had been sent overseas with the 2/2nd Australian General Hospital, one as a pathological laboratory assistant and one as secretary to the matron. These appointments were irregular as the question of the service of the Voluntary Aids in the A.I.F. was then still under consideration. It was not until October 1941 that the first regular overseas postings were made. In that month a party of Voluntary Aids embarked with their commandant, Miss M. M. C. Stephen, in the hospital ship *Wanganella*. Their destination was the 2/12th A.G.H. in Ceylon where they were to work hard but under pleasant conditions for more than a year.

In November a draft of 102 Voluntary Aids left for the Middle East under Miss M. McElhone. They arrived on 28th November and after staging at Kilo 89 Camp four were attached to A.I.F. Headquarters in Cairo and 98 to the 2/1st A.G.H. at Gaza and the 2/7th A.G.H. at Rehovot. Their career in the Middle East was interrupted by the declaration of war with Japan. The 2/6th A.G.H. took over from the 2/1st A.G.H., which left Gaza in March, the Voluntary Aids continuing to work with the 2/6th A.G.H. as well as with the 2/7th A.G.H. which moved to Sidon in July. Miss McElhone returned to Australia in March 1942, and Miss L. B. Irwin became the senior officer of the Voluntary Aids in the Middle East. This first draft did excellent work in many fields, but chiefly as nursing and ward orderlies, orderlies in special hospital departments, and as senior and junior clerks.

A further small group which saw oversea service during 1942 were 15 Voluntary Aids who were posted to the hospital ship *Oranje*.

Changes in uniform were introduced during this period when large numbers of Voluntary Aids were overseas. The original uniform was a dark blue dress in winter, pale blue in summer, and working overalls also of pale blue, with silver buttons, black shoes, grey stockings and a white veil. Voluntary Aids were responsible for the purchase of their own uniform, the army making them an allowance—£20 to those on the mainland and £37 to those overseas, as well as an annual allowance for maintenance. Replacements were difficult to obtain overseas and in April 1942 a khaki uniform similar to that of the Australian Women's Army Service was approved. Although many members of the service undoubtedly regretted the passing of the familiar blue dress, the change was in the interests of economy and uniformity. On the right arm of the new uniform, as of the old, the Geneva emblem was worn as the badge of the service, and caps and capes were added as suitable for the work to be done. A concession was made whereby members possessing blue uniforms were permitted to wear them until they became unserviceable.

While the scope of V.A.D. work was being successfully expanded overseas the increased demands being made on the Australian armed forces emphasised the need for a similar expansion in Australia. On 30th January 1942 the D.G.M.S. asked the D.D's.M.S. of the Eastern, Northern and Southern Commands to arrange for the detachments to assist in the care of sick and wounded passing along lines of communication in those areas. It was in a sense an unofficial prelude to mobilisation, and on 20th March the Military Board approved of the calling up of members of the V.A.D. to replace men as indicated in the war establishments of 600-bed and 1,200-bed hospitals.

The V.A.D. was now organised and administered as a service within the army medical service, with its own administrative officers in units, and senior representatives at the headquarters of each Command or Area. In September 1941 Mr S. S. Addison, secretary to the Joint Central Council of the V.A.D., had been appointed part-time Controller at headquarters for a period of three months, and subsequently Assistant Controllers were appointed in Eastern, Northern and Southern Commands, and Commandants in the 4th and 6th Military Districts and Western Command. Initial appointments were Mrs C. McVittie, briefly (Eastern Command), Miss M. Calder (Northern Command), Mrs A. R. Appleford (Southern Command), Miss M. Draper—later Langsford—(4th Military District), Miss I. D. Cox (6th Military District) and Miss S. C. Perry (Western Command). On 10th June Miss K. A. L. Best, the former matron of the 2/5th A.G.H., who had been taken on strength of the Medical Directorate with the rank of lieut-colonel, was appointed full-time Controller.

Three months later the control of the V.A.D. was vested in the army; the Assistant Controllers and Commandants were given army rank and in November an Assistant Controller, Major H. F. Meyer, was appointed to Land Headquarters. In February 1943 Lieut-Colonel Best was appointed Assistant Adjutant-General (Women's Services). Lieut-Colonel M. Walker succeeded her as Controller, and, when she retired in July of the same

year, Lieut-Colonel M. S. Douglas became Controller. Meanwhile Captain J. Snelling, the former Assistant Controller of the V.A.D. for N.S.W. and the Honorary Secretary of the Joint State Council, had become Assistant Controller for New South Wales, and Captain M. Roche Assistant Controller for Queensland.

To make for easier distinction between members of the V.A.D. employed by the army on full-time duties and those belonging to the civilian organisation not so employed the D.G.M.S. recommended that the designation of the Voluntary Aids in the army should be changed to the "Australian Army Medical Corps, Women's Service". The Adjutant-General, however, decided that the title should be "Australian Army Medical Women's Service". A protest was made by medical women's societies in New South Wales and Victoria concerning the name, on the grounds that the expression "medical women" meant women practitioners of medicine, being the analogue of "medical men". The Secretary for the Department of the Army replied in January 1943 that it seemed unlikely that confusion could arise and that no further change in the name was contemplated. The name has since become firmly established.

At the end of 1942 the Adjutant-General set out the duties of A.A.M.W.S. officers, but these orders did not clearly include the senior officers already appointed. These officers carried out many administrative duties which were later recognised as being in the province of staff officers, and it was only in early 1945 that a General Routine Order clarified the duties and responsibilities of the Controller of A.A.M.W.S. and all subordinate officers of the service. This established that A.A.M.W.S. officers were primarily concerned with the welfare and well-being of members of the service and their powers were defined in accordance with the Military Forces (Women's Services) Regulations. These difficulties and others already mentioned arose from the transition of an indeterminate type of service to one essentially governed by military regulations, and might have been more quickly resolved by prompt action at an earlier period. However, the efficiency of the service was never in question.

From July 1942 onwards A.A.M.W.S. were posted to medical units in the Northern Territory—at Alice Springs, Katherine, Adelaide River, Tennant Creek, Larrimah and Mataranka. The climate during the wet season was trying, but most of them stood up to it very well, even when on duty in kitchens and laundries. Because of the severity of conditions service in the Northern Territory, except at Alice Springs, was limited to 12 months.

A few members of the A.A.M.W.S. were also posted to a camp hospital at Mount Isa, and others to a mission hospital at Hall's Creek in the far north of Western Australia, possibly the most isolated place in which A.A.M.W.S. served.

The duty of the senior officer in the N.T., eventually described as Deputy Assistant Controller, was carried out in succession by Lieutenant M. A. Irving, Captain L. W. Yates, Captain Perry, who was transferred from Western Command, and Captain R. Birch, the last-named officer

remaining until the last member of the A.A.M.W.S. left the Territory in June 1946.

The Voluntary Aids who went overseas at the end of 1941 and soon after had all returned to Australia by the beginning of 1943: the 2/12th A.G.H. returned from Ceylon in December 1942; the Voluntary Aids in the *Oranje* were withdrawn about the same time, and those in the Middle East returned with the hospitals after the entry of Japan into the war. Most of these girls had been enrolled but not enlisted, and they were given the option of reposting or of discharge.

There was no further movement overseas until 1943 when numbers of the A.A.M.W.S. were sent to New Guinea. At the beginning of the year a group was brought up to the 46th Camp Hospital in Port Moresby, followed in August by a draft of 4 officers and 200 other ranks under Major J. L. Christie for the 2/9th and 2/7th A.G.H's. Later another detachment under Lieutenant M. Kelly arrived with the 2/8th A.G.H. In November 50 A.A.M.W.S. flew across the Owen Stanleys to Buna, where they played a large part in establishing the hospital. Instructed by medical officers, they received and treated patients and carried out all the hospital work until the arrival of the nurses eight days later. As the hospitals moved forward in the wake of the Australian forces, the A.A.M.W.S. accompanied them—to Dobodura, Lae and Finschhafen. In the concluding stages of the war members of the service were sent to New Britain, Bougainville, Hollandia, Morotai and Borneo.

The first members of the women's service to come to Port Moresby—the A.A.N.S.—often spent their nights in slit trenches, tin hats on their heads. By the time the A.A.M.W.S. arrived there was not much bombing but over the range at Buna they were often subjected to air attack. They also suffered the usual hazards incidental to service. In 1945 sixteen of them, members of the 2/5th A.G.H. at Morotai, had a narrow escape from death. The aircraft in which they and nurses from the hospital were returning to Australia on leave burst into flames soon after leaving Darwin. The pilot managed to land and the crew smashed the perspex machine-gun turrets at the sides and rear allowing the girls to jump out and get clear, but only seconds before the plane blew up.

The A.A.M.W.S. who served in the South-West Pacific Area worked hard—eight hours a day. The sickness rate among them was not excessive, although they suffered to a certain extent from tropical disease and most of them lost considerable weight. Twelve months was, therefore, set as their maximum period of service in the tropics, as it was in the Northern Territory. Experience also showed that in a hot climate certain duties such as work in kitchens and laundries was too hard for women, except for short periods, and in December 1943 special instructions were issued governing selection, qualifications and duty in tropical areas.

When off-duty the A.A.M.W.S. had many diversions. Naturally they were popular with the troops who showered them with invitations. A special club was built for them in Port Moresby, and there and elsewhere they could go swimming, picnicking and dancing. Their tropical working

uniform—a khaki overall, white veil, and ankle-socks instead of the regulation stockings if they so wished—had to be changed after 6 p.m. for the anti-malarial rig of safari jacket, trousers, woolly socks and boots. In this attire they would set forth in the evenings, wearing no make-up except lipstick, which had to be applied frequently as it melted so quickly. They were not allowed to go out except in parties and male escorts had to be armed. This posed quite a problem for would-be swains among artillerymen and naval gunners, who had access to 25-pounder field pieces and 6-inch naval guns but not to small arms!

Many A.A.M.W.S. married while still in the islands. With the help of fellow A.A.M.W.S. and army personnel most of them had a traditional wedding. Dental units would often produce the wedding ring, made from the gold used for teeth fillings, and formal wedding dresses and veils were conjured up in the most unlikely places. On two occasions in New Guinea a roll of white organdie was used, which had been salvaged by Australian troops in Eritrea. When one of the brides mentioned wistfully that she had always hoped to be married in blue the unit's dispenser was called in to concoct a dye. After the wedding the couple usually went off to spend the honeymoon on a near-by plantation.

In 1945 the Virginian Federation of Women's Clubs, U.S.A., provided twelve classic wedding gowns which could be borrowed by any Australian servicewoman marrying an Australian, American or other Allied serviceman.

When the war ended Lieutenant B. Morgan-Payler and several other ranks were attached to the Recovered Prisoners of War and Internees Camp on Labuan to look after the women and children there. A small group of A.A.M.W.S. under Captain Stephen accompanied the 2/14th A.G.H. to Singapore to care for prisoners of war liberated in the Far East, and in 1946 volunteers under Major F. McNab were posted to the 130th General Hospital, British Commonwealth Occupation Force in Japan.

The different types of unit in which A.A.M.W.S. served both on the mainland and overseas and the different types of work they carried out may now be recapitulated. The largest units to which they were posted were the army base hospitals where it was possible for them to replace males to the fullest extent. Concord Military Hospital had over 600 A.A.M.W.S. on its staff and Heidelberg almost as many. They were also sent to other general hospitals, repatriation, orthopaedic, women's and camp hospitals, convalescent depots, medical headquarters, aid posts for servicewomen, troop trains and training units.

Home officers. A shortage of trained nurses was causing some concern in 1944, and A.A.M.W.S. officers helped to ease the position by acting as "Home Sisters" and taking care of the nurses' mess and home, duties which were usually performed by a member of the A.A.N.S. in each hospital.

Officers posted to other services. Members of the A.A.M.W.S. were in certain instances permitted to nominate as potential officers in special departments, such as ordnance, to fill posts primarily intended for mem-

bers of the A.W.A.S. Women so appointed from the A.A.M.W.S. could be seconded only if holding commissioned rank, and with the proviso that they surrendered protection under the Geneva Convention. Service identity and A.I.F. status were retained. The duties for which A.A.M.W.S. were to be allotted in this way were defined at the end of December 1944 as being those related to movement and treatment of sick and wounded, or the administration of a medical unit; postings to schools and training units for women, and others specially approved by L.H.Q. Officers seconded for other postings were faced with the necessity of returning to their own service for reposting or transfer to the A.W.A.S., alternatives which threw into sharp relief the strong attachments to a service which its members acquire.

Other rank duties. From the time that general recruiting began there was so large a demand for personnel for general duties that no preliminary qualifications in nursing or ward work were insisted upon. At first members were given some choice of occupation on enlistment, but later on, as the vacancies for trained personnel were filled, most recruits were posted to general duties in kitchens, wards and messes, and it was often a considerable time before they had an opportunity of passing to more skilled duties.

Transport drivers. Women drivers were only permitted to drive vehicles of the ambulance car companies, and as these were A.A.S.C. units, they were driven by members of the A.W.A.S. Later, however, in 1944 alterations in hospital establishments permitted members of the A.A.M.W.S. to replace male A.A.M.C. drivers.

Postal and pay duties. In August 1942 permission was given for Voluntary Aids to carry out postal and clerical duties connected with pay in hospitals.

Part-time duties. Though it was not possible for members of the A.A.M.W.S. to be employed on part-time duties, no objection was raised to purely voluntary assistance being accepted without obligation to the army. Valuable work was done in this way by Voluntary Aids in units such as camp hospitals, and this maintained a link between the Voluntary Aids as a civil and service auxiliary body and the A.A.M.W.S. as an army organisation.

Diet Supervisors. In 1943 an officer of the A.A.M.W.S., Lieutenant A. J. B. Wunderly, was appointed to supervise cooking and catering in medical units. Later diet supervisors, ranked as warrant-officers Class II, were appointed to hospitals. Dietitians were posted only to base hospitals, and helped to train these supervisors.

Cooks. A number of A.A.M.W.S. served as cooks in medical units and hospitals, but not in the islands, where the work and conditions were unsuitable. Training was carried out in medical units and later in special schools.

Dispensers. A few members of the A.A.M.W.S. replaced male pharmacists, and several were later commissioned in the A.A.M.C.

Radiographers. Several members of the A.A.M.W.S. completed courses for radiographers and were posted to hospitals as technicians.

Laboratory assistants. Members of the A.A.M.W.S. carried out work of various kinds in the pathology departments of hospitals and in special units; several worked in the virus department of the Walter and Eliza Hall Institute in Melbourne; others at army blood serum preparation units in capital cities and several went to Morotai with the only army blood transfusion unit to work in forward areas. Some of them were highly trained and did responsible work.

Dental Clerk Orderlies. In this category a number of members of the A.A.M.W.S. served in dental units, before and after the establishment of a separate dental corps, and in the latter instance retained their service identity and protection under the Geneva Convention.

Operating Theatre Assistants. A number of these assistants were specially trained nursing orderlies, some with pre-service experience.

Nursing and Ward Orderlies. About 30 per cent of the service came into this category: they were specially trained in schools and by hospital experience.

Other categories. Other members of the service were employed as clerks and stenographers, hairdressers, telephonists, tailoresses and assistants in stores and laundries. Some A.A.M.W.S. stenographers worked at the psychiatric hospital, the 114th A.G.H., at a time when insufficiency of specially trained medical personnel created conditions of great difficulty and even hazard for female staff at the hospital. A small number of A.A.M.W.S. were employed on troop trains, where they maintained the regimental aid post, treating slight illnesses, doing dressings for minor injuries and acting as chaperones to servicewomen travelling on the train. Some staffed a hostel for American nurses in Victoria; and one attached to the facio-maxillary and plastic surgery unit at the 113th A.G.H. did very skilful work in painting artificial eyes.

It may be noted that changes were made in the trade groupings for A.A.M.W.S. suitable for tropical areas, and particular care was taken that unduly laborious work was not asked of them, and that their hours of duty were not too long.

Training. When general enlistment of Voluntary Aids began the need of some form of army training for recruits became obvious. In July 1942 the D.G.M.S. recommended that training schools for Voluntary Aids should be established in Victorian and New South Wales L of C areas; that administrative staff should be trained in the school which had been set up for A.W.A.S., and that N.C.O's should be trained as instructional staff in the A.A.M.C. school in Victoria. As a preliminary, nine potential instructors were selected and given a course of training, and in October recruit training began with the setting up of V.A.D. training companies in Victoria, New South Wales and Queensland, to each of which three instructors were appointed. Later it was decided that training of A.W.A.S. and A.A.M.W.S. should be amalgamated, and joint training companies were formed, the staff containing a proportion of A.A.M.W.S. Senior

officers were trained in the Army Women's Services administration school. Army Women's Services schools were used for training N.C.O's and the Army Women's Services officers' school for officers. In the medical units interesting courses of instruction were given on such subjects as elementary nursing, dietetics, hygiene, hospital asepsis, operating theatre technique, and so on. Unfortunately, however, there was no uniformity, and the nature and scope of instruction varied considerably.

In 1944 additional recruit training was provided for, an extra week's training in elementary medical work being added to the basic recruit training course.

The need of a central school had been felt since 1943 and in 1944 the A.A.M.W.S. Training School was established at Darley, Victoria, with a wing at Perth, to train nursing orderlies. At this time the strength of the A.A.M.W.S. was about 5,000, most of the members being concentrated in the base hospitals.

Pupil Nurse Training School. The Darley school was designed for a wider purpose than the training of orderlies. Reinforcements were required for the army nursing service, but they could not be obtained by calling up more civilians, there being already a shortage in the civilian community. It was felt that the army could help by providing partial training for nurses for its own hospitals. Accordingly in 1942 the medical directorate evolved a plan for a two years' course, based on the highest requirements of selection and on the syllabus of training for general nurses of the Nurses' Registration Boards in the several States. It was proposed that subjects which could not be studied in a military hospital would be taught in civilian hospitals. Trainees would be selected from members of the A.A.M.W.S. already enlisted and with the necessary educational qualifications. After the two years' course the trainees would be drafted to civil hospitals to complete their training, and it was hoped that the Nurses' Registration Boards would permit the initial two years' training to count towards their registration as trained nurses after passing the prescribed tests.

The Prime Minister sent full details of the scheme to the Premiers of all the States; by June 1943 replies had been received from every State except New South Wales. All other States agreed to recognise the scheme, with various suggested alterations and safeguards, but the New South Wales Government later replied that it could not recognise the plan, and suggested that representatives of the Commonwealth Government and the States Nurses' Registration Boards confer on the matter. Unfortunately premature and incomplete announcement of the plan in the press was followed by misconceptions, the most serious being that it was intended that after the war A.A.M.W.S. with only two years' training would be considered eligible for registration. This was completely unjustified. Surprisingly, however, the nurses' associations, particularly in New South Wales, voiced objections, and so much delay and misunderstanding occurred that many applicants were discouraged and gave up the idea of training. In January 1944 the suggested conference was held; the scheme was found acceptable

in principle, and the following resolutions were unanimously adopted and forwarded to the Prime Minister: that the syllabus be accepted entirely; that the D.G.M.S. and Matron-in-Chief should confer with the Nurses' Registration Board in New South Wales with a view to persuading the board to review its decision; that trainees completing the course in civil hospitals should be in all respects on the same footing as civil trainees; that arrangements be made to assure prompt absorption of the army trainees into civilian schools, and that the possibility of standardising training, pay and conditions of nurses throughout Australia be explored. Meanwhile the army went ahead with the plan, took steps to register the base hospitals other than Concord as training hospitals, and to select and draft suitable trainees to the Darley school for a preliminary course. The first school was opened in March 1944 by the D.G.M.S., with a membership of 80. Later students were brought from Perth to Darley, owing to the small numbers in Western Australia.

Training proceeded satisfactorily during 1944 and 1945 in every State except New South Wales. All efforts to introduce the scheme there failed, and all hope was relinquished of training there. This attitude was much regretted by the army medical services, and to some extent negated the value of the scheme. Trainees were subsequently transferred to civilian schools, being discharged when they were ready to enter hospitals.

Demobilisation. Towards the end of the war recruits for the service were falling off even from the V.A. Detachments themselves. This was possibly due to the revulsion of feeling against controls during a long war, and to such internal causes as the necessity for Voluntary Aids being given general duties on enlistment. Steps were taken to clear up such difficulties, but till the end of the war there was very little increase in the flow of recruits.

The demobilisation period was not without its troubles. Though the orders came into operation on 1st October 1945 they could not be put into general effect for some time because of the need for maintaining adequate staffs in army hospitals. Release of officers gave little trouble, as postings could be filled by volunteers in the units, but the other ranks were informed that they might be retained regardless of priority if their services were essential. Many of the women accepted deferment since their retention was largely due to the needs of the prisoners of war. In October 1945 male other ranks of the A.A.M.C. and members of the A.A.M.W.S. were declared key personnel by the D.G.M.S., but a sympathetic attitude was taken towards compassionate grounds for discharge. There were delays too in the taking over of military hospitals by the Repatriation Commission because of shortages of staff. In February 1946 the D.G.M.S. realised that a deficiency of A.A.M.W.S. staff was inevitable at least till the end of 1946, as discharges on various grounds were being pressed in most areas. Replacement by male orderlies was unlikely to fill the gap; and recruiting within the service produced only 400 women willing to serve for a further 18 months, and after consideration was abandoned. By August 1946 the demand was reduced by the gradual closing

of army medical units, but it was impossible to avoid retention of a certain number of staff until the Repatriation Commission was able to take over the hospitals.

The problems of rehabilitation had received early recognition. In the first years of the war the then Controller, Lieut-Colonel Best, had expressed concern for the post-war welfare of the thousands of young women who had joined the service, many of them straight from school. Service life had its compensations—physical well-being arising from a regular and healthy routine, the feeling of comradeship, and the like. On the other hand, a life which was planned from morning until night could lead to mental stagnation and to a feeling of security, which was likely to prove illusory in the post-war years.

To combat such trends an education service for women in the Services was established, the underlying principle of which was to stimulate and develop the natural feminine instincts which Service life could suppress. Cooking, dressmaking, baby care, handicrafts and gardening were some of the subjects taught. The training of A.A.M.W.S. as nurses, occupational therapists and radiographers has already been mentioned. So far as can be judged members of the A.A.M.W.S. emerged from the service well equipped for civilian life.

PART IV

OTHER SUBJECTS

CHAPTER 38

HOSPITAL SHIPS

DURING the 1914-18 War sea transport posed problems of great magnitude for Australia, for traffic of casualties through the Mediterranean and round the Cape called for special arrangements. In spite of the development of hospitals in forward and semi-forward areas, many ships were needed to carry patients from the Middle East to the United Kingdom and to Australia. These ships were known as "white" or "black" in the military vernacular of the day. "White" ships were brought under the protection of international conventions, and comprised fully equipped floating hospitals like the *Karoola* and the *Kanowna,* and the more temporary "hospital carriers" which could transport and deal with the less serious casualties. The "black" ships were sea ambulance transports, capable of carrying large numbers of lightly ill and convalescents in relative comfort; they sailed without red cross protection. Fast "black" ships could brave a solitary journey. The hazards of the rest were lessened by travelling in convoys, a mixed blessing, for all who have travelled in convoys know that irritating slow ship which determines the rate of all. There were instances of British "black" transports which were later officially converted to "white" ships. Both types suffered attack on a number of occasions, but all the patients who returned to Australia by these varied forms of sea transport arrived safely.

During the war of 1939-45 conditions experienced by Australians were in the main very different in the two chief areas of action, the Middle East and the South-West Pacific. The problems related to hospital ships depend upon geographical conditions, the magnitude of the forces involved, the tempo and extent of military action, the number and types of battle and non-battle casualties, the kind of medical service demanded of the ships' staffs, and the mutual arrangements made by Allied national powers. Further, the growing use of aircraft in evacuation introduces a most significant factor in estimating the need for hospital ships.

A word may be said about arrangements for the mutual use of hospital ships by Allies. Cooperation was full and valuable during the war, and when Allies and in particular members of the British Commonwealth were fighting in the same areas they often travelled in each other's ships. The antipodean partners reserved space for each other so that New Zealanders might use Australian ships, and Australians travelled also on the *Maunganui,* the New Zealand hospital ship. The British, who were involved in large-scale operations over wide fields, advocated pooling of hospital ships, but this was hardly practicable where Australian and New Zealand ships were concerned, except over short runs in delimited zones. In addition there was that spirit of independence which is a tenet of the Australian people, who always wished their men to travel in Australian ships, and to be treated in Australian hospitals by Australians. This of

course was often not possible, and Australians were grateful for the generous help of the British in this regard and the invaluable and irreplaceable protection given by the fighting ships which, often at heavy cost to themselves, escorted and also carried so many soldiers of the dominions.

Fitting and Equipping Hospital Ships. Before considering the careers of ships some attention must first be paid to the nature, structure and function of hospital ships. There were four fully-equipped hospital ships at the service of the Australian armed forces: *Manunda* and *Wanganella,* converted from relatively new and well-found passenger liners; *Oranje,* a palatial liner most generously converted, run and maintained by the Netherlands Government; and, in the Pacific war, *Centaur,* lost through enemy action on her first full-duty trip. The problems of conversion of liners to hospital ships are manifold, and their solution demands the special knowledge of a body of technical experts of the navy, the merchant marine, and the army, and of the administrative and practising branches of medicine.

In the selection of a ship for the purposes of a transport and a hospital there are certain common requirements. The size is important, as the draught of a big ship may be a bar to full mobility: she may not be able to approach shallow waters or lie up in shallow anchorage, and this complicates loading and unloading. *Manunda* and *Wanganella,* 9,000 to 10,000 tons gross, were of ideal size. Speed should be sufficient to give a quick turn-round, at least 14 knots. Motor ships have advantages: diesel-engined craft have ample electric power at their disposal, and can use exhaust heat to distil fresh water. The water-supply is important. Average warships need 10 tons a day for each 100 men, but the *Manunda* used 50 tons daily for each 100 men, with another 50 tons a week for the laundry, a vital factor on a hospital ship. An emergency boiler unit produced another 10 to 15 tons a day, but these smaller distillation plants were not always very successful. The *Wanganella* had similar restrictions in the water-supply, and needed more than the 825 tons she could carry. The *Oranje* carried no more than this but could make 300 tons of fresh water a day. The range of a hospital ship may thus be limited by its water-supply, as its average requirements are not less than 30 to 35 gallons a head a day, allowing an extra day's ration each week for laundry.

Ventilation was also important. These ships used punkah-louvre systems, but additional ventilation was needed in some parts, especially in the wards in the tropics or during rough weather when ports were closed. In the operating theatre some form of air conditioning, or an exhaust system with special diffusion arrangements designed to avoid draughts was required. Fully equipped hospital ships included a special theatre block, comprising the theatre, a plaster room, and X-ray department, all constructed as one unit. Proper lighting was another essential feature, as maximum illumination had to be secured without glare, preferably using an indirect system. A movable light was necessary in the theatre, and special care had to be taken in installing it so that it could occupy elect positions for operating without being disturbed by movement of the ship.

The cots used were according to a standard pattern found satisfactory in other ships. The value of swinging cots has been debated. They were useful in special fracture cases, being of course capable of being immobilised, but on the whole fixed cots such as those in the *Oranje* were very satisfactory. Both single and double-tiered types were used: the latter were most useful when the upper one was removable. Wherever possible some three feet of space round each cot was allowed. Accommodation in the ships was chiefly in wards, but in the *Oranje* some blocks of cabins were retained by desire of the owners and were used with doors removed. Special wards were provided for orthopaedic cases, patients seriously ill, and those with tuberculosis, infectious diseases, mental affections and venereal disease. Special observation rooms and strong rooms were provided for psychiatric cases.

Certain other features were common to all hospital ships, such as separate dining accommodation for convalescent patients, and staff, standard diets of four simple types, and sufficient room for occupational therapy and exercise.

Most important were the arrangements for embarkation and disembarkation. Winches, and special stretchers such as the Neil Robertson stretcher and the Stokes litter permitted the handling of the helpless without disturbance, but after their arrival on the deck or at sea doors there still remained the problem of their transfer to wards. This was a question to be answered differently on each ship, and in some instances considerable structural alterations were needed. Broad approaches, minimum use of stairs, which must be of easy gradient, passenger lifts to the various decks, and careful planning were necessary to ensure an uninterrupted flow of traffic. It was repeatedly found that delays in embarkation of sick and wounded were far more likely to be due to slow diffusion of the patients through the ship than to tardy delivery of stretchers on the deck. Occasionally, as on the *Oranje,* lifts were too short to take an unmodified stretcher; an additional power lift was found necessary in this ship.

Finally, the possibility of rapid abandonment of a hospital ship had to be considered: apart from deliberate hostile action a ship might strike a mine or be involved in other marine accident. The lifeboats provided on liners were insufficient in number, for many patients could not help themselves, and they took longer to load, and occupied more space than people who were fully mobile. Up to 50 per cent increase on normal requirements for rescue gear was not excessive on a hospital ship; this could be supplied by extra lifeboats, but rafts and Carley floats were found preferable.

The *Manunda, Wanganella* and *Centaur* were taken over by arrangement between the Australian Government and the owners for conversion as hospital ships, and the alterations were carried out under direction of the Royal Australian Navy. All the various interests involved were represented, and the experts concerned worked together with great harmony and efficiency. The only unfortunate incident was a serious hold-up in the sailing of the *Manunda* on her first trip, due to an industrial dispute

by engineers. Experience showed that it was highly desirable that the military commander of the ship should be at hand during the period of conversion to advise on the myriad problems which would only be solvable by one who had to run the ship as a hospital.

It is convenient here to remark on the method of control adopted on Australian hospital ships. The ship was a military unit whose senior medical officer was the officer commanding troops, and he administered the unit as an army general hospital of from 300 to 600 beds. The navy carried out maintenance and determined the ship's movements from the point of view of security and safety, and the Merchant Navy was responsible for the sailing of the ship.

The *Oranje* was unique in its method of control, as the use of this ship with its entire cost of maintenance while carrying Australian and New Zealand sick and wounded between the Middle and Far East to Australia was a gift from the Netherlands East Indies Government. Further details of administration will be given later. Particulars of the conversion and use of the *Centaur* may also be left for later description, as this ship belonged to a different period of the war.

During the period 1940-42 Australian sick and wounded were transported over both short and long sea routes. To and from Australia and the Middle East the distances were long, but risks were slight, though some uncertainty was felt about whether raiders might interfere with protected ships. These trips were made by hospital ships or returning transports according to the needs of the sick or unfit, and contrasted with the short but hazardous journeys along the North African coast and to and from Greece and Crete. The hospital ships were of course self-contained as regards staff, but the sea ambulance transports returning to Australia were staffed from an A.A.M.C. pool, which also helped to staff unarmed and defensively armed transports in the Mediterranean. Medical and nursing staffs for outward-bound transports were simply supplied from those travelling to join the A.I.F. in the Middle East. The use of large ships for the carriage of troops necessitated a break of journey in India, or later, Colombo, and therefore arrangements were made at these ports for hospital attention.

For short runs in the Mediterranean British hospital ships were often used for Australian casualties, there being no Australian hospital ships on this run. In addition defensively armed ships were employed, and other transports. A brief account may be here interpolated of some of the experiences of members of the Australian medical services on these ships. During the first Libyan campaign there were few air ambulances, and sea transport was most valuable, as it saved wounded men the discomfort of a long and usually rough journey by road. Sea distances in this part of the Mediterranean were relatively short, and there was a high degree of moral ascendancy in the area, in spite of the strong Italian fleet and the ever-present danger of air attack.



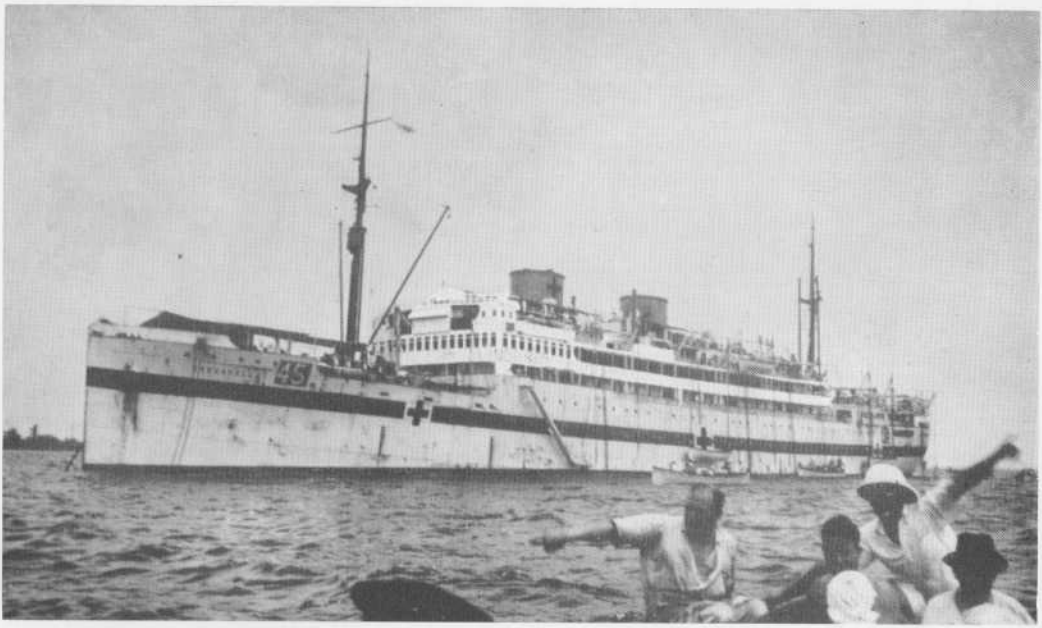
(Australian War Memorial)

A conference of the Controller and Assistant and Deputy Assistant Controllers of the A.A.M.W.S. held in Melbourne in 1945. Seated round table from extreme left they are: Lieut-Colonel M. S. Douglas (Controller), Major A. R. Appleford (Victoria), Major M. C. Roche (Queensland), Captain M. M. Langsford (South Australia), Major H. F. Meyer (Western Command), Captain I. D. Cox (Tasmania), Captain L. W. Yates (Northern Territory), Major J. M. Snelling (New South Wales), Major R. M. Davidson (L.H.Q.) and Captain S. C. Perry (Northern Territory).

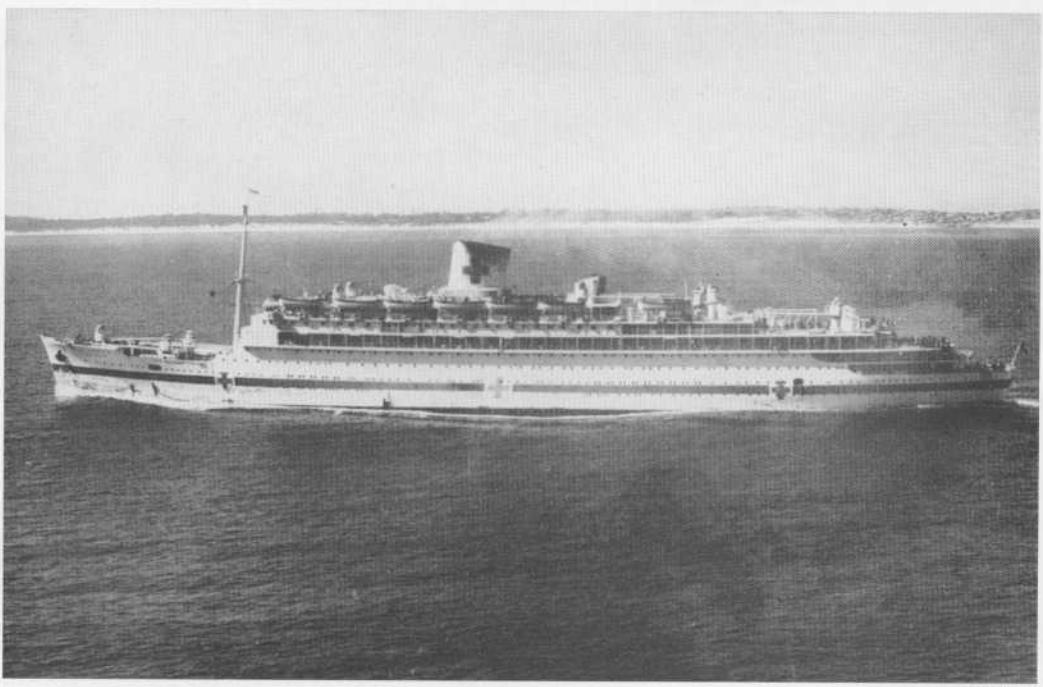


(Australian War Memorial)

Members of the A.A.N.S. and A.A.M.W.S. leaving a hospital ship in a lifeboat for Tarakan, Borneo.

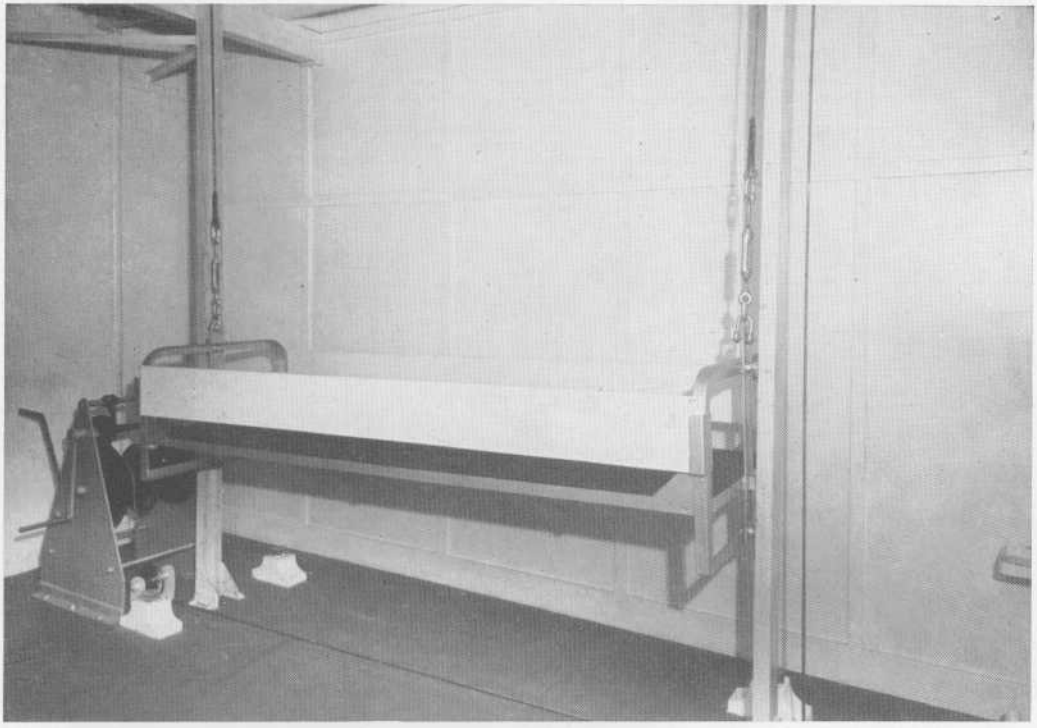


The 2/2nd Hospital Ship *Wanganella*.



(*R.A.N.*)

The hospital ship *Oranje*, outward bound from Fremantle, August 1941.

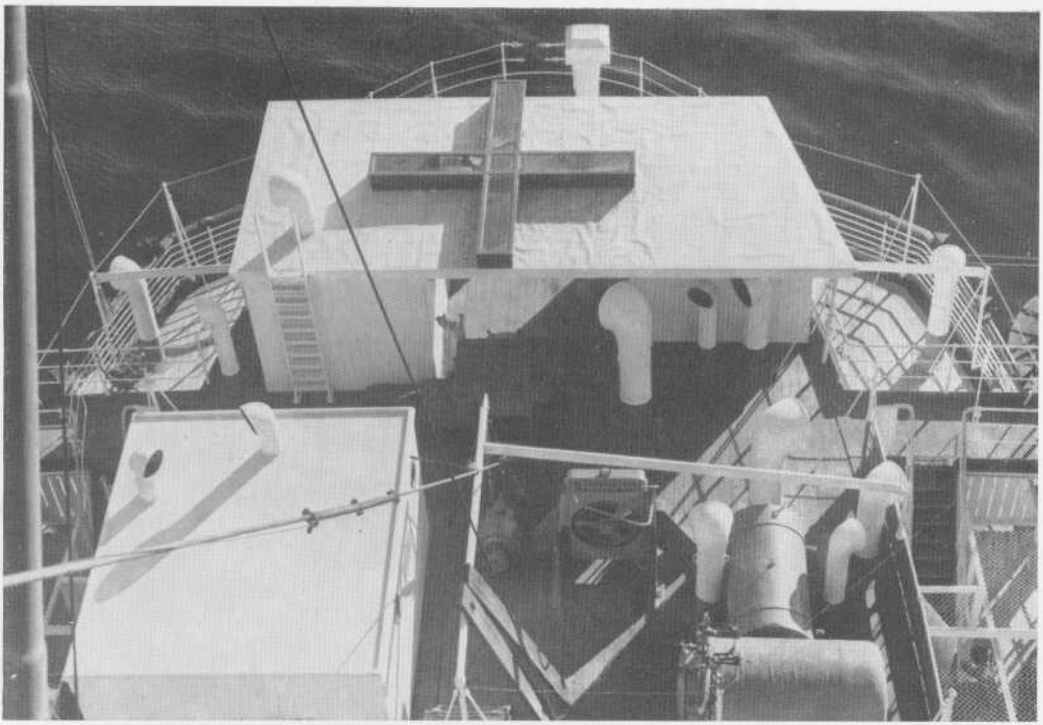


Cot lift in the hospital ship *Manunda*.

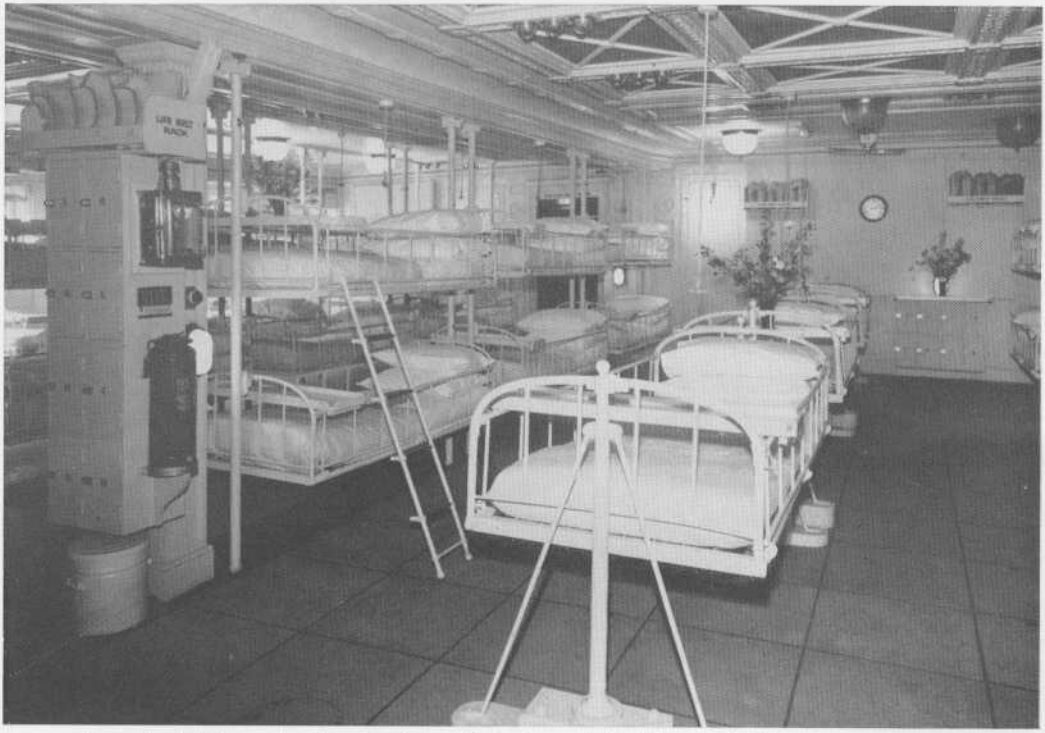


(*R.A.N.*)

Wounded being taken aboard the hospital ship *Wanganella* at Balikpapan, Borneo.



The deck of *Manunda* with decontamination unit and disinfector in foreground and electrically lit red cross in background.



A ward of *Manunda*, showing type of single and double cot, ladder for approaching top cot, patients' lockers, accessory oil lamp lighting and punkah-louvre system of ventilation. Single beds are raised on blocks to a height of 2 feet 6 inches to facilitate nursing.

A small armed carrier belonging to the Egyptian Government, *El Amira Fawzia,* took patients back from Salum and Mersa Matruh to Alexandria. It could accommodate 122 lying casualties. Troops and prisoners were also carried in considerable numbers on the lower boat deck; this was a hazard, for in emergency it might have been difficult to hold lifeboat accommodation for patients and staff against the competition of prisoners. In case of trouble the medical staff was armed. The resources of this vessel were strained at times, as on one trip when 850 troops were carried from Mersa Matruh to Salum. On such trips the already insufficient sanitary arrangements became quite inadequate. The ship was of shallow draught, fast, and easy to manoeuvre in and out of the cramped harbours, and did much useful work, although by reason of its charter it could not go past the Egyptian border. Major J. H. Stubbe, A.A.M.C., was in charge, with a staff of two other medical officers and 17 other ranks. In ten trips, made over a period of six weeks, *Fawzia* carried 219 British and 257 Italian stretcher patients, and 445 and 644 walking wounded. In addition 4,721 unwounded prisoners and 3,490 British troops were transported, a total of 9,776.

One transport serving in the Mediterranean, the *Chantala,* an armed merchant ship of 3,500 tons, was sunk while on sea ambulance work. Captain N. F. Laidlaw, with 10 other ranks rostered for ambulance service, travelled on this ship from Alexandria to Tobruk in 1941. On the return trip on 7th December the ship survived air attacks, but was sunk by a mine. A number of German and Italian prisoners were on board, and a few lightly wounded. No stretcher patients were taken since the sister ship, *Chakdina,* had been torpedoed the previous night. One hundred and twenty prisoners were killed by the explosion, and the remainder in fear obstructed the work of rescue. However, Laidlaw and his staff got away as many survivors as possible on lighters and boats, and the party reached Tobruk safely; some of them returned to Alexandria on the hospital ship *Somersetshire.* Other members of the Australian party started back on another ship, the *Shuntien,* which was torpedoed 60 miles off Tobruk. Most of the men were rescued after being a couple of hours in the water, but a medical officer, Captain C. S. Donald, and five orderlies were lost.

Though Australian hospital ships were not used in the Mediterranean, experiences with British hospital ships determined a most important change of policy there. During the siege of Tobruk the sea was the vital link in the chain of communication. Even if the privileges of hospital ships under international conventions were observed, these ships still sailed in perilous waters. On 14th April 1941 the British hospital ship, *Vita,* was attacked in Tobruk harbour by dive-bombers at 5 p.m. on a bright afternoon, just after leaving anchorage with 422 patients. Near misses caused serious damage which flooded the engine room and left the ship helpless. The R.A.N. destroyer, *Waterhen,* was unsuccessful in an attempt to tow the ship, but she took the patients off, and *Vita,* carrying only baggage, was later towed back to Alexandria. At the end of April 1941 another hospital

ship, *Karapara,* fouled a boom when leaving Tobruk in a dust storm, and caused anxiety for some hours lest she should be attacked. Although fortunate on this occasion she was attacked on 4th May during a heavy air raid after having taken on 164 sitting patients, and was forced to leave with only one engine working. These experiences shattered any remaining faith in the inviolacy of hospital ships leaving Tobruk, and in any case *Dorsetshire* was the only other hospital ship immediately available there. All patients from Tobruk were thereafter sent back to Alexandria in destroyers and other smaller fighting ships. Though there were great difficulties in accommodating and looking after sick men on board ships designed only for combat, the patients were given all possible care and consideration, and reached their destination promptly and usually in good condition. Apt organisation and the joint efforts of all concerned ensured remarkable speed and gentleness in embarkation from land hospital to the ships.

Greece provided experience of a different kind. The German Air Force made Piraeus a very dangerous port and inflicted great damage on it. When the decision was made to send all nurses back to Egypt about half the establishment of one A.G.H. embarked on the hospital ship *Aba,* but an air raid then forced the ship to sea, leaving a number still to be taken off. The naval authorities did not consider that the risks of using hospital ships under existing conditions were justifiable. Accordingly the remaining British, Australian and New Zealand nurses were transported by hazardous but well organised movements to points in the Peloponnese, where cruisers, destroyers and transports picked them up with the troops—fit but tired men, as well as walking wounded—and took them all to Egypt. It is obvious that hospital ships alone could not have coped with these problems of evacuation.

Crete told still another story. Before the threatened German air invasion took place all efforts were made to return to Egypt those whose presence could not assist the military effort: these included unarmed troops, all nurses, and unneeded medical officers. During this period of respite transports loaded in Suda Bay and returned to Egypt under naval escort; adequate medical attention was provided on board to both servicemen and civilians. On 5th May *Aba,* with great difficulty, embarked 600 patients from small boats in Suda Bay and returned them in safety to Alexandria. During the next week two transports took off medical units and other troops; one of these, the *Lossiebank,* caused her 2,000 passengers anxiety when one engine broke down, but both ships survived air attacks and arrived without loss. On 16th May *Aba* returned and took off 561 patients, mostly from the 7th British General Hospital. On her voyage from Suda Bay to Haifa *Aba* was attacked by aircraft, but suffered no serious damage.

As is well known, the final evacuation from Crete was made from the little cliff-bound beach of Sfakia, where destroyers at great risk and with considerable losses embarked on six nights some 17,000 troops, including some sick and wounded.

Before these attacks on *Vita, Karapara* and *Aba* the British Government had protested through the United States that no less than 31 attacks had been made by enemy aircraft and shore batteries on hospital carriers and ships, sinking three. After further attacks the British intercepted the Italian hospital ship *Ramb IV* off Aden and took it over for temporary use as a hospital ship to replace one of those lost. This unique reprisal, if such it could be termed, had an attached condition that the *Ramb IV* would be used for British and Italian wounded and returned after six months if no further attacks were made. This arrangement was terminated on 10th May 1942 when the *Ramb IV* was involved in an enemy air attack at Alexandria and sank with the loss of 150 lives. Though this part of the narrative does not deal directly with Australian hospital ships it concerns the safety of Australian sick and wounded, and touches on a number of episodes which had an important effect on naval and military policy towards all hospital ships.

To it may now be added a brief account of the careers of the three hospital ships *Manunda, Wanganella* and *Oranje,* during the 1940-42 period, together with some significant features of their history.

The first trips of the *Manunda* were to the Middle East. The possible dangers run by a hospital ship were illustrated during her second voyage, when she was delayed for some weeks at Ismailia and in Lake Timsah by the dropping of mines in the canal by enemy aircraft. While in the Bitter Lakes a Greek ship moving out in advance of the *Manunda* struck a mine, and *Manunda* ran further risks by being tied up in the vicinity of a vessel with a load of T.N.T. while raids were going on. This question of anchorage will be mentioned later.

Towards the end of 1941 the *Manunda* had a quiet period, and remained in Sydney with the staff on leave from 17th September till the beginning of 1942, when she was sent to Darwin. During the first part of this period the services of a hospital ship were asked for in Malaya, but by the time the *Manunda* arrived in Darwin on 14th January, the position in Malaya was so serious that the sending of a hospital ship was regarded as an unjustifiable risk. After a further period of waiting a convoy of troops bound westward from Darwin was heavily attacked from the air, and was ordered back to port. There could be little doubt about the significance of this warning, and on the now historic 19th February 1942 the blow fell on Darwin. A number of naval and other ships were then anchored in the harbour, and a precautionary dimming of lights had been ordered. The American naval units and merchant ships were blacked out, and the master of the *Manunda* followed this example, though the Australian naval vessels were brightly lit, as were also the wharves where work was proceeding day and night.

It should be noted that though the *Manunda* was anchored well away from the wharf area she was in the centre of a ring of naval and merchant ships, and could hardly have missed damage from bombs meant for the others. At 10.5 a.m. on 19th February a bomb fell near the wharf—observers on the *Manunda* were certain that this was the first warning—

immediately followed by the sounding of air raid sirens on shore. A Japanese aircraft formation flew over, dropping a series of bombs, and, swinging round, came in for another attack in which the *British Motorist* was sunk and the *Neptune* and *Zealandia* set on fire. Eight ships were lost including American and Australian naval units. The *Manunda* was damaged by a near-miss which seriously affected the instruments on the bridge, while another bomb lit fires and wrecked the social and living quarters in forward parts of the ship. One military officer, one nurse, one corporal, and two officers and seven ratings of the crew were killed, while a number of others were wounded. The *Manunda's* motor lifeboat picked up over 30 badly burnt and injured men from the water. Next day 19 deaths were reported from the ship, and later 15 more.

The medical staff worked with cool competence, showing the results of months of experience and assiduous training for emergencies. Patients had to be carried by hand as the lifts went out of action, and by nightfall there were 76 in the ship, the theatre operating to capacity till after midnight. Fortunately the ship was still seaworthy, and the engineering staff worked hard to repair the damaged fire mains and steering gear. One hundred and ninety wounded and sick were embarked during the next afternoon, and at 11.30 p.m. on 20th February the *Manunda* sailed for Fremantle. In spite of the severe damage to the navigation instruments and the depletion of ship's staff, the *Manunda* reached Fremantle safely and, having left most of the patients there, went on to Adelaide and later to Melbourne for repairs.

After completion of repairs the ship resumed work, taking up the New Guinea run to Moresby and Milne Bay. On one of these trips remarkable incidents occurred in Milne Bay in striking contrast with those at Darwin. At 10.30 p.m. on 6th September the *Manunda* was anchored in the bay when a Japanese cruiser and a destroyer drew in, inspected the brightly lit ship and the surrounding waters with searchlights, and then bombarded the wharf and airfields area, sank the motor vessel *Anshun,* but did not fire on the hospital ship. The next night a Japanese cruiser again bombarded the area but spared the *Manunda.* Further episodes in the ship's career in the Pacific area belong to the later period. The successive commanders were Lieut-Colonels J. M. Beith, J. B. McElhone and G. R. Halloran.

The *Wanganella,* whose size and lay-out were similar to those of the *Manunda,* proved very satisfactory as a hospital ship for a little under 400 patients, and 150 more in canvas cots in emergency. Her first trip was to Singapore on 15th to 17th September 1941, after which she was sent to Suez and Colombo and Darwin for a succession of trips. In the earlier part of the Pacific war the *Wanganella* like the *Manunda* served the New Guinea ports and visited Milne Bay and later still went to the Solomons and to Borneo. By request of the New Zealand force in Italy a special trip was made to Taranto.

One experience of the *Wanganella* in the East, in April 1944, showed the value of training and preparedness in a hospital ship. This was an

emergency due to a serious explosion on the waterfront in Bombay in which thousands of people were killed or injured. The whole resources of the ship were employed, and two surgical teams worked for over 24 hours. The value of a course in anaesthesia taken in Sydney a little time before by medical officers of the ship was apparent, as expertly given gas and oxygen proved most useful. Patients were held on board for three days, and then were discharged to civilian hospitals. The first O.C. troops was Lieut-Colonel R. L. Lenihan, who was succeeded by Lieut-Colonel F. Brown Craig.

Though occasional quiet periods were experienced in this ship's career, work went on regularly and without disruption through the war: many sea miles were covered, and a high standard of work was maintained. Indeed, the *Wanganella* had the satisfaction of performing service of a continuous kind which was not the lot of other hospital ships.

In February 1941 the Netherlands East Indies Government offered the use of the *Oranje,* a fast new motor liner of 20,000 tons hitherto reserved for service as an auxiliary cruiser, as a hospital ship on the Middle East-Australia-New Zealand run. The Dutch authorities offered to equip, man and operate the ship at their own expense; this most generous offer was accepted subject to the right of Australia to withdraw should the operating power be involved in hostilities in the Far East. A combined Australian mission, including Lieut-Colonel J. B. D. Galbraith as the representative of the Army Medical Directorate in Australia, flew to Batavia to discuss the medical and engineering problems involved, and the ship came to Sydney for the work of conversion. Colonel Galbraith's experience was valuable as he had been associated with the refitting of the other hospital ships. The Netherlands Government insisted on bearing the whole cost of conversion, though the Australian and New Zealand Governments carried the uninsurable war risk after Japan entered the war.

Oranje completed two runs to the Middle East and back before December 1941, and in these trips her speed and capacity (650 cots) enabled her to transport 900 men in short time in a high degree of comfort. Shortly after the *Oranje* left the waters of the Netherlands East Indies on her second trip war broke out with Japan, and it is interesting in the light of after-knowledge that the ship's course on nearing Australian waters ran close to the position where the *Sydney* at this time sank the German raider *Kormoran* and was herself lost.

Some of the problems of administration of the *Oranje* were unusual. All medical and surgical treatment was carried out by the highly trained and skilled members of the Dutch medical services on board. There was also a small Australian and New Zealand liaison staff, including initially Lieut-Colonels Galbraith and R. F. Wilson, who were the Officers Commanding Australian and New Zealand troops, and of Lieut-Colonels A. J. Aspinall and J. P. Major, Consulting Surgeon and Consulting Physician respectively. In this way some contact with the patients was maintained. The officers commanding were responsible for discipline and the duties of convalescent patients and acted as advisers to the Dutch commander

on the treatment of patients, final decisions resting with the commander. The then D.G.M.S., Major-General F. A. Maguire, doubted if these arrangements would work, and regarded them as an experiment. Inevitably difficulties occurred. For example, all leave was granted by the hospital commander, who was handicapped by a lack of knowledge of Australian Army regulations and practice. During 1942 other liaison officers were appointed, and some of the problems were clarified at a conference at Australian Army Headquarters. Difficulties arose at higher levels also, but these were due mainly to internal differences within the Army Headquarters. For example, in March 1942, the Adjutant-General, Major-General V. P. H. Stantke, proposed to disembark patients from the *Oranje* at Fremantle and turn the ship round rapidly for dispatch to Java. Major-General Maguire, protesting at not having been consulted, pointed out that if the *Oranje* evacuated civilians from Java as proposed, additional medical staff and more medical supplies would be needed. After some delay this voyage was cancelled owing to the rapid deterioration of the position in the Netherlands East Indies.

After March 1942 the Australian and New Zealand attached staffs were no longer regarded as a financial responsibility of the Netherlands East Indies Government, and the expenses were debited to the British Ministry of War Transport. The original staff of Australians in the *Oranje,* as well as the medical officers, included a quartermaster, two senior members of the Army Nursing Service, two physiotherapists, two staff-sergeants and twelve other ranks. To these were later added Voluntary Aids. After the Australian troops had been withdrawn from the Middle East at the end of 1942 the war took different shape for Australia, and by reason of the dangers in the South-West Pacific and the great need for medical officers in Australia all Australians were taken off the *Oranje* and replaced by British. The *Oranje* was a most valuable addition to the fleet of hospital ships serving the Middle East, and after the end of the war this ship again rendered service to Australia by transporting prisoners of war.

The most outstanding events of the period 1943-45 in the Pacific so far as hospital ships were concerned, were the commissioning and loss of the *Centaur,* the changes caused by the development of amphibious warfare and combined landings, and an increase in the air transport of sick and wounded.

Local conditions in the islands, particularly with regard to navigation, embarkation and disembarkation, suggested the use of smaller hospital ships. The United States forces commissioned the *Mactan,* and early in 1943 the Australian Army took over the *Centaur* for conversion to a hospital ship. At first this ship of 3,200 tons was planned as a hospital carrier fitted for short trips, but so many improvements were incorporated that eventually *Centaur* was converted to a modern hospital ship capable of carrying 280 cot cases on voyages of up to 18 days if required. The first estimate of cost rose from £20,000 to £55,000, owing to the greater scope of alterations, which included an extensive hot water system, a larger

operating theatre, and extension of galley and refrigeration service. The crew's quarters, originally designed for a native crew, were greatly improved at the instance of the unions concerned. The ship was notified as a hospital ship to the Japanese Government through the Protecting Power on 5th February 1943, and full publicity given by press and radio. On 14th May 1943 *Centaur* sailed, unescorted, on her first fully equipped voyage north. She was properly marked, and brightly illuminated, showing navigation lights, red crosses on the hull and on each side of the funnel, with white lights along a green band on the hull, that is, in accordance with *Article 5* of the Hague Convention for the Adaptation of Maritime Warfare and in observance of the principles of the Geneva Convention. At 4.15 a.m. while steaming at 12 knots in fine weather about 24 miles from Point Lookout on the Queensland coast the *Centaur* was struck without warning on the port side forward by what was believed to be a torpedo. There was a loud explosion, flames enveloped the forward part of the bridge, and the ship lurched to port and sank in two to three minutes. She was carrying her crew and normal staff, and members, stores, and equipment of the 2/12th Australian Field Ambulance, but no patients. There were only 64 survivors; 268 lost their lives, including 222 military personnel. On 15th May at 2 p.m. the U.S. destroyer *Mugford* sighted rafts and signalled an escorting Anson plane, which investigated and signalled back "Rescue survivors in water ahead". The cruiser *Sussex* was informed, and *Mugford* found two large groups and three smaller groups of survivors on rafts within a 2 mile radius; there was one wrecked lifeboat and another floated keel up. Oil and debris were on the water in the neighbourhood. One nurse, Sister E. Savage, survived and gave great help to the other survivors, all of whom suffered hardship from exposure. The American destroyer gave them every attention and the ship's crew most generously made a collection for them. Further enquiries confirmed that the attack was without warning, and was believed to be part of the torpedoing of a series of eight other vessels off the coast. Some survivors stated they saw the outline of a submarine surface after the *Centaur* sank but this was unconfirmed. No radio message was sent out: only two deck officers survived and it was thought that the radio was made inoperable by the explosion.

Rumours circulated that troops were on the *Centaur* carrying arms, but there was no evidence of any infringement of International Law. Lieut-Colonel L. M. Outridge, commanding the field ambulance, which was proceeding on duty to New Guinea, was one of the few survivors, and was able to verify the fact that the the embarkation had been strictly in conformity with the relevant sections of the Convention. Medical officers may be armed provided their arms are used only in defence of their patients if these are attacked. The drivers of the ambulance vehicles were attached personnel of the Australian Army Service Corps and carried arms, as was usual, and in accordance with the military establishment.

The Australian Government made a protest to the Japanese Government through the Protecting Power on 18th May 1943. There is some

evidence that a Japanese military authority claimed that no Japanese submarines were in the vicinity, and that there was no record of any submarine sinking a ship there. However, this is at variance with the whole of the evidence, and there seems no doubt that the *Centaur* was torpedoed.

The repercussions from this tragic loss were considerable. The immediate effect was similar to that observed on other occasions when hospital ships were attacked: that is, faith was lost in the safety of registered hospital ships. The problem is similar to that of attacks on medical units on land.

On 18th May 1943, when the news of the loss of the *Centaur* became public, the staff of the *Manunda* was on leave with a nominal headquarters in Sydney. They made an offer to take up the *Centaur's* work, and on 19th May they were recalled, but after sailing up the harbour the *Manunda* was turned round and brought back and tied up in Darling Harbour. For the next three weeks the *Manunda's* staff was on 24 hours' notice. Then on 14th June they were dispersed to other duties and work began on the ship to convert her to a defensively armed vessel for sailing in convoy. *Manunda* was painted grey; gun mountings were installed, and arrangements were made to accommodate 15 or more naval gunners on board. Medical opinion was opposed to the conversion, and on 28th June 1943 the D.G.M.S., Major-General Burston, wrote to the Adjutant-General that the elimination of distinctive markings for hospitals ships was equivalent to admitting that the provisions of the Geneva Convention did not hold good. Surely an enemy on realising such an admission would feel that protection of other medical units was illusory and would act accordingly. Burston pointed out that the *Manunda* must be the first hospital ship registered with enemy governments that had been so altered, and strongly recommended that the project be reconsidered. On 10th July the ship went to sea for gunnery trials and returned, but on 9th August Lieut-Colonel McElhone, commanding the unit, was informed that the ship was to be reconverted to a hospital ship. A week later work began at Cockatoo Dock to remove gun emplacements. On 24th August the unit was reassembled and on the 30th the ship sailed for Brisbane as a hospital ship. After a further month's inactivity the *Manunda* sailed to New Guinea, but on return to Brisbane lay idle, moving from anchorage to anchorage until December, when she visited Thursday Island and Moresby, and early in 1944 travelled up and down the Australian coast.

Meanwhile, with air transport growing in volume and several sea ambulance transports in use for return trips from the island to the mainland, the particular services for which hospital ships were essential were less in demand. In addition there were more permanent hospitals in New Guinea. After the initial difficulties of land evacuation of sick and wounded from forward areas had been overcome, all ordinary treatment could be carried out there. A suggestion was made to fit out the *Gorgon,* a somewhat larger ship than the *Centaur,* as a hospital ship, but these considerations and the acute shortage of shipping disposed of this plan.

At Army Headquarters certain technical questions relating to hospital ships had been under examination for some time before the loss of the *Centaur*. These were important as they chiefly concerned the transport of medical units, a function which was found to be particularly valuable in the South-West Pacific. Towards the close of 1942, before the conversion of the *Centaur* was begun, the legality of carrying ambulance vehicles on hospital ships was in some doubt. Major-General John A. Chapman, Deputy Adjutant and Quartermaster-General at Advanced L.H.Q. in Brisbane, pointed out to Land Headquarters in Melbourne that the army instructions were not quite clear, nor were those from the Naval Board repeating an Admiralty instruction. The point was whether ambulance waggons could be so carried except as part of a complete medical unit and its equipment. It was further stated in the instructions that the first ambulance of a field unit for land service might be carried, if alternative transport was not available, a condition not entirely clear.

In reply the Adjutant-General cancelled an instruction of 20th October 1942, and on 5th January 1943 substituted a full restatement listing all personnel who could be carried on a hospital ship, and clarifying the position concerning arms and material. This instructed that alternative transport of powered ambulances should be used if available, and that the carriage of persons and material be refused if relevant authorities took exception to them.

After the sinking of the *Centaur* the whole position was re-investigated, and a further instruction was issued on 6th October 1943, but even this was not final, and a consolidated instruction was finally issued on 3rd July 1944. This outlined clearly the need to comply with the requirements of the navy in deciding what persons could be legally carried as crew, passengers or patients. A restriction was now laid on those carried as part of complete formed units; only members of the A.A.M.C. could be so carried. The result of this was to take ambulance drivers, previously belonging to an ambulance car company, A.A.S.C., into the establishment of the A.A.M.C. Further, no units or individuals performing quasi-medical functions if not belonging to the A.A.M.C. could be carried on a hospital ship even if attached to a medical unit. Strict definitions of medical units were reaffirmed, which excluded from the category convalescent depots, entomological units and hygiene sections.

Personal weapons only were allowed and permanent guards for sick or wounded prisoners of war could not be carried, only a guard embarked for a particular voyage, and notified to the enemy Powers. Materials and stores carried were clearly defined.

Comparison with the relevant sections of the Conventions shows that the effect of this instruction has been to state clearly what is implied in the Convention, and even at the cost of some rigidity, to ensure the interpretation of the spirit as well as the letter of the law. The examination of war diaries of hospital ships makes it clear that the military commanders have been strict guardians of International Law, and any objections they had taken, even if unsuccessfully, to certain procedures have usually been

soundly based. This does not imply that the conduct of Australian hospital ships in all significant matters was other than strictly ethical, and based on the sure foundation of laws designed for the protection of the helpless. No restrictive conditions were imposed on the patients carried, who were drawn from many categories of distressed persons.

The Royal Australian Navy held views in some ways different from those of the army concerning hospital ships. It is interesting to recall that when the Royal Naval establishment at Garden Island, Sydney, was taken over by the R.A.N. on 1st July 1913 complete medical stores and fittings were also taken over for the use of a hospital ship provided for in the mobilisation scheme of the Admiralty. During the 1914-18 War the Navy Department took over the merchant liner *Grantala* which was used as a hospital ship during the expedition to Rabaul. After the successful conclusion of the Falkland Islands action the *Grantala* was paid off and returned to her owners. It is possible that the Royal Australian Navy might have had more intimate control of hospital ships in 1914-18 had the conditions of warfare on land and sea not brought Australian naval services more naturally under control of the Admiralty. Even before September 1939 the medical branch of the Royal Australian Navy advocated the manning and running of hospital ships by naval personnel. The question of direct control of hospital ships by the navy was raised again during the war but no action along these lines was taken. At a conference of naval and military surgeons including Australians, which was held in Washington soon after the beginning of the war, the opinion was expressed that hospital ships should be controlled by one Service, thus avoiding many problems which may arise between the captain of the ship and the military commander of the hospital. In 1940 the Director of Naval Medical Services, Surgeon Captain W. J. Carr, drew up a minute recommending that hospital ships, as distinct from hospital carriers, should be used, and that they should be converted, manned and equipped by the navy. In February 1941 the *Wanganella* was the subject of such proposals, but the D.G.M.S. in a letter to the D.N.M.S. pointed out that the Committee of Service Medical Directors considered it best not to retain the *Wanganella* for naval purposes, but to use the ship for care of casualties of all Services from the Middle East, the Far East and Darwin, and for naval needs in an emergency. If further naval requirements arose a hospital carrier could be improvised. The D.N.M.S., however, considered that further naval facilities were essential, and that the *Wanganella* should be controlled by the navy. As has been previously told, the combined method of control, under which the navy supervised or carried out the conversion and maintenance and routeing of hospital ships, while the merchant navy sailed the ships and the army controlled the hospital as a military unit, was retained.

Naval control played an important part in combined operations and amphibious landings. Armed merchant cruisers and L.S.I. or L.S.T. sailed with the convoys, and they carried special medical staffs which could provide surgical teams in addition to the technical assistance normally avail-

able in land field units. Such vessels were not protected under the Geneva Conventions. Craft of smaller size or shallower draught took troops and material in to the beaches, and at as early a stage as was safe the medical portions of the landing parties. These set up immediately the attendant ships could provide supplies, but they treated only urgent cases, the small craft taking other sick and wounded back to the ships. There all work could be done that would ordinarily be carried out on land in the M.D.S. of a field ambulance or a forward section of a casualty clearing station. Treatment on craft such as Landing Ships Transport was not always ideal, as some medical and surgical conditions called for special facilities, and, as far as possible, patients were carried only for brief periods, although under certain conditions longer holding periods were unavoidable.

Small craft were also employed for evacuation of patients along the coast of New Guinea and other islands. Details of these operations are not relevant to the story of hospital ships; we may merely note that special ancillary beach units were established by the army medical services to provide the first stage in water transport, and from these patients were taken off by craft of about 80 feet, which could carry up to 27. The later stages of evacuation were by air, using flying-boats or land-based aircraft, and the final stage by the comfortable hospital ship.

As we have seen, the R.A.N. Medical Services advocated hospital ships as distinct from hospital carriers for the sea transport of Service casualties. Surgeon Captain L. Lockwood pointed out, however, that hospital ships were expensive and that other types of sea transport were of value where the sea distances were great. For the rapid embarkation and transfer of sick and wounded fast escort types of vessels could be used as carriers protected under the Convention. These could collect wounded near an operational area and transfer them to a hospital ship or a forward hospital farther away from the operational area, from which the patients could be transferred to the mainland if required. Certain serious embarrassments had been encountered in the handling of casualties in naval engagements. In a combined Services conference on hospital ships in 1946 Surgeon Commander J. M. Flattery instanced the sea actions off Leyte and Lingayen. Wounded were held perforce in the *Australia* under extemporised conditions on stretchers in ward rooms and messes. A modern fighting ship is designed only for fighting, and under action conditions the medical officers are sufficiently occupied without the further responsibility involved in holding large numbers of casualties. After one action the *Australia* had to return 800 miles to Manus, three days' steaming, to meet a hospital ship at sea; in a dangerous area the transfer of wounded to this ship was no light responsibility. The principal risk was not to the hospital ship but to the cruiser, a ready target for an enemy submarine. To the wounded the ordeal was considerable too, but even more trying was that of being taken back into action in a fighting ship, in which the patients lay helpless often with guns firing overhead. In amphibious landings the American Navy had hospital ships, armed transports, and hospital

teams on ships ready for landing, the arrangement being that the hospital ship should arrive at a determined period after the landing.

One of the most gratifying tasks for hospital ships was that of repatriating captured servicemen and women suffering from disease and malnutrition, after the harsh conditions of prison camps. Only the more seriously ill patients fell into the hospital ship category, but to them the service was of the highest value. The *Manunda, Wanganella* and *Oranje* all participated in this work: *Manunda* and *Oranje* took patients from Singapore, *Wanganella* from Borneo, and men from Ambon were evacuated by fighting ships of the Royal Australian Navy. In passing it may be observed that an important principle was observed in allotting accommodation to repatriates travelling on transports. In Singapore Lieut-Colonel G. T. Gibson, A.D.M.S. of the Prisoner-of-War Recovery Group, insisted that ample space should be allowed for debilitated men. After argument he was able to establish his point, and only 800 were embarked on the transport *Duntroon* instead of the 1,300 originally suggested by the British authorities.

Questions Governing Safety of Hospital Ships. Even regulation lighting may be unsatisfactory if means are not taken to maintain its efficiency. The Dominions Office sent out a dispatch on the subject, advising that

(1) colour of crosses should be true bright pillar-box red;
(2) marks to be of maximum size permitted by the superstructure, especially those meant for recognition from the air;
(3) three crosses be placed on each side of the hull and two on deck, one forward and one aft;
(4) glass fronts of illuminated crosses should be hinged to the outside of boxes;
(5) boxes should be painted white and reflectors used.

More difficult to settle were some of the arguments whether the hospital ship should black-out in dangerous waters or remain lit. A number of instances occurred when a hospital ship was directed to an anchorage which was not of itself completely safe, and yet objection was taken by naval authorities to the use of the Geneva lights and emblem on the grounds that these could easily disclose the presence of fighting ships. In Moresby harbour in 1942 the *Manunda* extinguished its lights on naval instruction, though the area was not completely blacked-out, searchlights being in use. Here the O.C. troops thought the lights should have been lit. The same situation arose at Morotai and Biak, and protest was made by a hospital ship that the protection which was its right was in danger of being denied. In 1941 the master of the *Oranje* suggested that if challenged by an enemy when the ship was lighted he would extinguish lights and go full speed. The Australian staff considered this contrary to the Geneva Convention. Though there is nothing to prevent a hospital ship from blacking-out in a dangerous area or one where the ship's lights might betray the presence of other ships, and though blacking-out does not contravene the Convention, it must be remembered that such action lessens the right of complaint if a ship is endangered or damaged. A

striking example of protection afforded a hospital ship when fully lit at night occurred in Milne Bay. As already described, a Japanese cruiser entered the bay and, after inspecting the *Manunda* with a searchlight, left without making any hostile gesture to the ship.

It has been stated that no hospital ship should be anchored nearer to the heart of a danger zone than 40 miles. Suez was notoriously dangerous, and owing to the constant risk of air raids the arrangement was that hospital ships should not arrive too early nor stay too late. If embarkation had not been completed by early afternoon the ship had to steam down the Gulf and return next morning. In August 1941 the South African hospital ship *Amra* was attacked near Suez. A torpedo-carrying plane circled the ship and fired two torpedoes which missed. The *Amra* was blacked-out at the time, though it was thought that the distinctive markings would be seen in the bright moonlight. This seems unduly optimistic but fortunately no damage was done. *Oranje,* on her first voyage, picked up the *Amra's* S.O.S. while in the Gulf of Suez. *Oranje* herself, though handicapped by a draught which forced her to lie offshore, was extremely efficient in embarking patients. For example on 28th November 1941, 460 patients were embarked and fed between 11 a.m. and 1.10 p.m. Another hospital ship *Manunda* was exposed to unnecessary hazard at Suez when she was allotted a dangerous anchorage—close to a ship which was found to be carrying explosives. The damage later suffered by *Manunda* in the Darwin raid illustrated how dangerous to a hospital ship is the proximity of other ships not protected by the Conventions.

If a hospital ship has been notified to the enemy through the Protecting Power in accordance with the Geneva Convention, if the personnel and stores carried are correct, and if its distinctive markings are likewise clear and correct, the ship is entitled to full protection. The distinctive marks of a hospital ship should be seen more readily from the air than those on tents and huts, but tests have shown that a red cross on a white ground 16 feet square though easily visible at 4,500 feet, is only just perceptible at 8,000 feet. At 10,000 feet only the white ground is visible, and at 11,500 feet even this cannot be seen.

The identity of passengers has also given rise to controversy; this has now been covered clearly in the consolidated army instruction of July 1944, already quoted (see Appendix). The question of arms has also been mentioned. All these points should be scrupulously observed for reasons of legal and moral rectitude, and of humanity. It will also be remembered that the enemy has the right to question or examine hospital ships for a valid reason.

The success of defensively armed transports and other craft unprotected by the Geneva Convention demonstrated that there are other satisfactory methods of evacuation of the sick and wounded besides hospital ships. The position has been changed too by the wider application and excellent organisation of air transport of patients. It is difficult to prophesy what advances will be made, but it cannot be said that the point has been

reached where the hospital ship is obsolete. There is no other method of transport of the sick and wounded over long distances which secures them so high a degree of comfort allied with a very high standard of medical attention.

APPENDIX

Use of Hospital Ships (Army Instruction July 1944)

2. (*a*) Difficulties have arisen in the interpretation and application of the principles governing the use of hospital ships for the carriage of personnel and material and the questions of policy and interpretation involved have been under consideration by the High Command.

(*b*) The following consolidated instructions are now issued for the guidance of all members of the A.M.F. concerned with the embarkation of personnel and the loading of material on hospital ships.

Compliance with Requirements of the Navy

3. As a substantial share of responsibility is borne by the navy, no personnel or material to which the naval authorities object will be embarked, loaded, or carried on a hospital ship.

Doubtful Cases

4. Every effort must be made to maintain the immunity of hospital ships from attack by the enemy and, therefore, in cases of doubt, personnel or material involved should not be embarked, or carried on a hospital ship.

Who and What may be carried

5. Personnel who may be carried fall into two main categories, namely the crew and staffs for the ship itself and passengers.

Ship's Crew and Staffs

6. The ship's crew and staffs include all those personnel whether combatant or non-combatant necessary for the navigation and running of the ship and for the care of the passengers. These personnel are by the nature of their duties engaged exclusively in the collection, transport and treatment of the wounded or sick. Australian military personnel so carried will therefore be restricted to personnel who are duly posted within the war establishment for the ship's staff.

Individuals Who May be Carried as Passengers

7. Individuals who may be carried as passengers include:

(*a*) Sick or wounded personnel of any fighting service of any belligerent.

(*b*) Shipwrecked (including air wrecked or castaway) persons of any nationality or status.

(*c*) Strictly medical personnel of any of the fighting services of any belligerent. (Australian military personnel in this category are members of the Australian Army Medical Corps, the Australian Army Dental Corps, the Australian Army Nursing Service.) These may be carried either on the outward or homeward voyage.

(*d*) Invalid wives (accompanied by their children of tender years) of personnel of any of the fighting services of any belligerent.

(*e*) Reliefs for hospital ship crews and staffs. These may be carried either on the outward or homeward voyage.

(*f*) Sick or wounded merchant seamen or civil air crews
  (i) of belligerent nations, and
  (ii) of neutral nations when such personnel may be regarded as serving the cause of the United Nations, e.g. by serving in British ships.

Who May be Carried in Formed Units

8. (*a*) In addition, the personnel of a complete military medical unit may be carried by a hospital ship as a formed unit, provided that all personnel carried are A.A.M.C. personnel. Such a formed unit may be carried either on the outward or homeward voyage.

(*b*) The following must *not* be carried on a hospital ship:

(i) Units or personnel performing quasi-medical functions but not being units or personnel of A.A.M.C., e.g. ambulance car companies A.A.S.C.

(ii) Personnel not members of A.A.M.C. attached (either within W.E. or Supernumerary) to a medical unit.

Who May be Carried as Guards

9. A permanent guard for sick or wounded prisoners of war may not be carried as part of the staff of a hospital ship. With special approval an armed guard may be embarked for a particular voyage to guard sick or wounded prisoners of war. Notification through the Protecting Power to enemy powers would be necessary.

Personnel Who May Not be Carried

10. (*a*) Sick and wounded personnel means personnel who will actually require medical and/or nursing attention during the voyage. Consequently convalescent personnel, and personnel being returned by reason of their being over age, or in need of recuperative leave, or unfit for service in the field will not be carried.

(*b*) Strictly medical and dental personnel only may be carried as individual passengers but any other non-combatant personnel—e.g. Chaplains and Red Cross personnel—may not be carried as individual passengers (notwithstanding that they belong to a medical unit) unless they fall within one of the other categories of personnel who may be carried (vide paras 6 and 7).

(*c*) Convalescent depots, entomological units or hygiene sections are not medical units, and consequently neither these units nor their personnel may be carried unless those personnel fall within one of the other categories of personnel who may be carried (vide paras 6 and 7).

Weapons of Personnel

11. For the purpose of maintaining order and for defending the sick and wounded, personal weapons may be carried on a hospital ship by—

(*a*) the ship's crew and staff;

(*b*) an armed guard where special approval for a guard for enemy prisoners of war has been given;

(*c*) all personnel travelling as passengers who are entitled to the protection of the Red Cross Convention.

Material

12. A hospital ship may be used to carry the following medical material and stores:

(*a*) Material and stores for the purposes of the ship and the treatment and care of patients and personnel on board.

(*b*) Personal belongings of the personnel on board.

(*c*) Medical and dental stores, provided that—

(i) They are supplies peculiar to medical or dental units; and

(ii) They are in packages clearly marked with the red cross and addressed to the medical or dental unit for which they are destined. They must not be marked for ordnance depots.

(*d*) Where a complete medical or dental unit is being carried, the full equipment of that unit except vehicles.

Ammunition

13. Reserve ammunition for weapons of personnel travelling on a hospital ship and entitled to carry personal weapons may not be carried in a hospital ship.

CHAPTER 39

THE GENEVA CONVENTIONS

THIS chapter is based on the experiences of the Australian Army Medical Services in the war of 1939-45, insofar as they were affected by the principles of the Geneva Conventions, and is designed to be complementary to similar accounts of the experiences of the other medical services of the British Commonwealth of Nations. Little can be said of the navy or air force, about which sufficient data are unavailable, or about civilians, who do not come within the scope of present considerations. Nor can any great detail be supplied, as problems of evidence make it difficult to determine the reliability or otherwise of many of the so called facts.

Under the Geneva Conventions protection is extended to medical establishments and medical staffs, to sick and wounded under the care of medical staffs, and to certain non-medical personnel attached to and engaged solely in the work of medical establishments, such as chaplains, drivers and scientific non-medical workers. Nurses and other female personnel, medical or non-medical, in the medical units have right of protection. Rights of nurses, as female members of a force, are undoubted. Some nursing services use military ranks, but all have the usual privileges of women if taken prisoner.

The recognition and identification by the enemy of medical staff, patients and others with recognised rights under the conventions were not always immediate. Sometimes the difficulty was due to illiteracy; members of the enemy forces were often unable to recognise the nature of the identification, and Japanese prisoners on occasion denied all knowledge of the nature of the well-known marks of identification such as brassards and cards.

Attacks on medical units. As described in a previous chapter, the protection extended to hospital ships under the conventions was somewhat uncertain. Nor could the inviolacy of medical establishments on land be relied upon. They were often attacked, and the circumstances of some of the attacks are difficult to explain, unless it is admitted that they were deliberate.

In the Tobruk area many bombing attacks, some from high altitude, were made on medical units on land and at sea. The 2/4th Australian General Hospital was in two sections, the main one in an Italian barracks, and a tented one on the beach, and both were frequently bombed. The main hospital buildings were fairly well protected and sandbagged but, in spite of this, heavy bombs damaged wards and caused casualties.

On 10th April 1941 at 6.30 p.m. both sections were attacked from the air, and 35 staff and patients were killed. This was not a high-level attack and was believed by eye-witnesses to be deliberate. The main hospital buildings were marked by five red crosses which were small but clear in

the daylight. However, there were an army field workshop, a bakery and a water-point behind the hospital, and vehicles were often standing near by. In the beach section two tents were destroyed; they were clearly marked with a large red cross and there were other emblems 12 feet and 6 feet square respectively on the ground. One stick of bombs landed 10 yards from a red cross.

At the end of April the beach section of the hospital was again hit from the air, but this was during heavy air raids which in themselves had caused a number of Australian casualties. This section was in the normal line of approach for aircraft and there were ammunition dumps near by. The dumps were removed after protest from the medical corps. It was later decided to move the beach section itself. On the new site large tents were used; they were pitched in the form of a Geneva Cross, and the roofs were painted red.

The 2/8th Field Ambulance which was in the Tobruk area was also attacked. On 28th May five bombs were dropped on the main dressing station, although it was identifiable as a medical unit by a large red cross made from groundsheets. The attack appeared to be premeditated, but proof is difficult.

Some protection for sick and wounded within the Tobruk perimeter was given by caves, which offered a natural defence. These, together with dug-outs, were used by the medical services as extemporised hospitals. They were particularly useful in nursing patients with fear and anxiety states, and periods of rest therein were extended up to several days where necessary. It should be noted that convalescents after illness are, strictly speaking, not included in those given special protection by the Geneva Conventions. There is no evidence that special attempts were made by the enemy to bomb this particular area, although it was within reach of shell fire, and at times these units were subject to shelling.

The necessary movement of wounded through danger zones in the area often attracted enemy dive-bombing. However, it seems probable that many of these attacks were part of the general manoeuvres, for on other occasions the Germans actually cooperated in the collection of wounded. After a heavy German attack on the Medauuar salient the 24th Brigade carried out a counter-attack in which both sides suffered heavy losses. The collection of casualties was slow and difficult. One party, consisting of a chaplain and bearer sergeant from the 2/43rd Battalion, drove in a truck marked with the Geneva emblem to a German post where the Germans helped the Australians to pick up wounded, even to the extent of an engineer making part of a minefield safe to permit the removal of the body of one of the dead. Unfortunately Australian artillery in error shelled a German post marked with a red cross, and these privileges were then withdrawn. Next day German troops fired on an Australian lorry marked with a red cross, presumably as a reprisal.

In the Pacific theatre also many bombing attacks were made on medical units. At the end of 1942 the 5th Casualty Clearing Station, which was situated 17 miles from Port Moresby, was attacked on a number of

occasions. Bombs ranging from small anti-personnel ones to the heavier types, and incendiaries, were dropped across the area without warning. However, the site had previously been occupied by other units not engaged in strictly medical work, and it would seem that the 5th C.C.S. was involved fortuitously. This was not the case, however, with the bombing of the 2nd U.S. Field Hospital. This unit was attacked by enemy bombers at Dobodura. It was thought that it had not been recognised as a medical unit, as unpacking was proceeding at the time, and it was assumed that it would be immune from attack thereafter, but after a time the unit was attacked again while occupying an open site which was thought readily identifiable as one used by a medical unit.

Protection of Medical Units with Arms. The Geneva Conventions clearly recognised the right of medical officers to protect helpless patients even with arms.

Thus, on the Owen Stanley Range at Menari the Australian forces, including the sick and wounded, were during one night within very close range of the enemy, and, to ensure their safety, guards were provided armed with rifles. This protection of patients who were unable to help themselves by reason of disability was quite within the rights conferred by the conventions. During the assault on Finschhafen a light section of the 2/3rd Casualty Clearing Station and the 2/8th Field Ambulance's Main Dressing Station were sited at Scarlet Beach. The position was soon revealed to be dangerous, and these units were subjected to considerable and frequent attack from the air. One bomb struck a corner of a ward and the ward tents were riddled with bullets, but the precaution of digging in had been observed, and no casualties occurred. Here medical units were sited dangerously, but the precaution of digging in to provide shelter was rightly taken.

At Sanananda Point during the final severe engagement of the Buna and Gona campaign precautions were taken to arm guards for the safety of patients, as the Japanese were expected to attempt to break through the Australian lines. Since natives would not act as stretcher bearers in this locality because of the danger, bearing was carried out by members of the Australian forces. Sections on patrol were accompanied by a trained stretcher-bearer orderly who was sometimes armed as well as medically equipped. The carrying of arms by the stretcher bearers was valid to protect the helpless.

On 4th May 1945, at Tarakan, fighting took place through the night in the neighbourhood of the 2/11th Field Ambulance with firing of small arms and 3.7-inch and 25-pounder guns. The M.D.S. was actually between the tactical headquarters of two battalions, 200 yards from the 2/24th and 600 yards from the 2/48th. The diarist commented that "it was a fine thing to have Harley Street in the front line; there was at least the consolation that no M.D.S. in history can have been nearer the front line". Under conditions such as these it might be exceedingly difficult to draw distinctions between combatants and non-combatants.

Four days later the 2/11th Field Ambulance was the scene of a very

distressing incident. At 3 o'clock in the morning a Japanese infiltrated through the picquets and placed a bomb under the bed of a patient in the isolation ward. The patient was killed instantly and two others in the tent were slightly injured. The Japanese evidently sat on the latrine near by to fuse the bomb and left his sword there and some glass bombs. Had opportunity occurred to attack the author of this outrage there could be no questioning the rights conferred by the Geneva Convention.

On Bougainville during July 1945 there was widespread infiltration by small parties of the enemy. It was found necessary to enclose the M.D.S. of the 15th Australian Field Ambulance within a wire perimeter with four guard posts; a Bren gun was acquired to increase firepower, and some booby traps set each night outside the wire. This provided legitimate protection for patients. The increase of armament in the cause of protection has no further reason than expediency, but the principle remains the same.

Problems of camouflage as a means of protection. In certain instances, when medical units such as field ambulances were near the enemy, arguments arose with the command as to the desirability of camouflaging the units without employing the Geneva emblem.

For example in June 1943 during the Wau-Salamaua campaign a strong protest was made by the medical services against a direction by the local command to remove the red cross from the M.D.S. of the 15th Field Ambulance. The Assistant Director of Medical Services and other responsible medical officers recognised that either the adequate display of the Geneva emblem or total concealment was admissible as a means of protection, but Lieut-Colonel W. D. Refshauge, Senior Medical Officer of the area, pointed out that sudden removal of the emblem would foster the enemy's belief that the site was not occupied by a medical unit, thus increasing the risk to which it was subjected. Continuous experience in this area indicated that the Japanese were respecting the Geneva emblem. It should be realised that camouflage may be used as a means of protection in various ways in conformity with the tenets of the Geneva Conventions; it is permissible by means of selection of a suitable site or by protection by concealment.

At Dumpu in the Ramu Valley in 1943-44 medical units were occasionally bombed, but no damage was suffered. Again the divisional command did not approve of red cross ground signs, and asked that slit trenches be prepared. All care was used in siting the medical units and these were well dispersed. Such precautions would afford reasonable protection, but medical officers felt that the rights of protection under the Conventions should not be abandoned, especially in the instance of members of the forces with special right for protection, such as sick and wounded. It is admitted, nevertheless, that the special protection provided by the use of the Geneva emblem might make the dispositions of the forces more evident to the enemy. On the other hand the enemy could possibly gain an equivalent degree of information by reconnaissance alone.

On 27th November 1942, during the Buna-Gona actions, the 2/4th Australian Field Ambulance at Soputa was bombed and strafed in a low-

level attack by Japanese aircraft. Severe damage was inflicted on the M.D.S., and a number of patients and members of the unit were killed or wounded. There seemed no doubt that the attack was deliberate—Japanese aircraft had made a low-level reconnaissance of the area a few days before—but it must be admitted that the disposition of this unit was not ideal for safety. The M.D.S. was alongside the main track and only 100 yards from divisional headquarters, though the red cross and the Australian flag were clearly flown. Lieut-Colonel E. C. Palmer pointed out later that it was better for a medical unit to set up behind forward positions and seek the protection of the jungle, as the 2/4th did afterwards, a precaution which in no way invalidates the unit's rights under the Geneva Convention. He also stressed the risks of leaving obvious tracks, particularly motor tracks in long grass, or jeep tracks in mud.

The 126th American Combat Clearing Station in the same area was also attacked but had removed its red cross the day before. The Americans had taken alarm after the reconnaissances by Japanese planes, whose interest had apparently been aroused when American aircraft dropped stores, using the flags as a marker.

The value of natural camouflage was tested out in many ways, and in conjunction with other simple methods. It was well recognised that for safety a tent such as an operating tent must be relatively light-proof after dark. The American pyramidal tent was useful in this regard. Camouflage at night was also achieved by the use of palm leaves spread on the walls of tents.

If the Japanese sometimes showed a flagrant disregard for the rights of their enemies under the Geneva Conventions, they were equally indifferent about their own rights. During the fighting on Tarakan in June 1945 when they were being very hard-pressed, a message was sent to their commanders; the courage of the Japanese in battle was recognised; appreciation was expressed of their generosity in respecting *Manunda* as a hospital ship though within a battle area, and an offer was made, in compliance with the principles of the Geneva Conventions, which would allow their wounded to have proper care. It was proposed that the Allied forces would cease fire at noon on 5th June, and Japanese representatives, wearing white brassards and carrying a large white flag, and unarmed, would advance to the meeting point, where an Allied medical officer would discuss arrangements for treatment of casualties. Courtesy and safety were guaranteed. In the event of refusal no further measures would be taken. At the appointed time on the 5th the Japanese fired two shells into the area, and it was decided by the Allied forces that this was their answer.

Prisoners of War: The Australian Red Cross Society played a notable part during the war in supplying medical units of all Services with drugs and dressings, special diets and medical comforts not provided for by the Service concerned. Convalescent and rest camps were provided with equipment and trained staff for diversional therapy as well as large quantities of sporting gear and table games. In some instances convalescent homes

(usually a stately home in extensive grounds) were completely equipped and staffed by the Australian Red Cross Society.

But probably the most noble work of the Red Cross was carried out among prisoners of war of all nationalities. The executive body was the International Committee of the Red Cross, with headquarters at Geneva, to which the Australian Red Cross Society was a contributing national society.[1]

After the 1914-18 War, the International Committee of the Red Cross lost no time in profiting by the experience gained. Its first objective was to improve the conditions of those who might become prisoners of war by giving them a regular statute. The initiative of the committee and the extent of its work had so impressed representatives of Governments and Red Cross Societies comprising the Tenth International Conference in 1921 that they invited the International Committee at once to draw up a draft code along the lines of its proposals. The Diplomatic Conference of 1929 adopted the committee's draft and it became the "Geneva Convention of July 27, 1929, relative to the Treatment of Prisoners of War", sometimes known as the "Prisoners-of-War Code". This convention is historic in that it established a prisoner of war as a juridical person with his own statute and laid upon the captor nation considerably more obligation towards its captive, than vice versa. Moreover the intervention of a private organisation, the International Committee of the Red Cross, is expressly provided for in a document signed by governments only.

The work of the International Committee of the Red Cross for prisoners of war during the Second World War may be divided into three categories: (1) the Central Information Agency; (2) the forwarding of relief supplies; and (3) general activities on behalf of prisoners. Under *Article 79* of the 1929 Convention, the International Committee of the Red Cross was required to establish in a neutral country a central agency of information about prisoners of war, to collect all information possible through official or private channels and to transmit the information as rapidly as possible to the prisoners' own country or the Power in whose forces they had been serving.

Article 77 of the convention provided that belligerent nations and neutral Powers having belligerents in their care, should set up their own Information Bureau and should inform it as soon as possible of all captures of prisoners by their armed forces, together with particulars of identity, and addresses to which letters might be sent to the prisoners. The Information Bureau would then forward such information to the Central Agency. *Article 77* also charged Detaining Powers with supplying subsequent information about their prisoners, such as transfers, releases on parole, repatriation, escapes, stays in hospital and deaths; this additional information was to be conveyed by the Central Agency to the nations concerned in weekly lists.

The 1929 Convention covered prisoners of war only, and in 1939 the

[1] Australia's contribution to the International Committee of the Red Cross between 1941-46 was 1,135,225 Swiss francs—4.26 per cent of the world total for that period.

position of civilians was governed by no international treaty. The International Committee of the Red Cross, however, succeeded in obtaining the belligerent Governments' agreement that civilians who were in enemy territory at the outbreak of war and who were interned should benefit by the prisoner-of-war clauses of the 1929 Convention.

The International Committee of the Red Cross did not await the outbreak of a major war before creating the Central Agency, but in May 1938 set to work to build a framework around which the necessary structure could be speedily developed should events call for it. A committee of six, appointed in September 1938 to decide upon organisation and functions, held 25 meetings before the outbreak of war and was then able to approach the belligerent Powers, not with a proposal to set up the agency, but to offer the services of a body that was ready to function immediately. The Central Prisoners of War Agency provided a direct link between prisoners of war and their next-of-kin and also between millions of civilians who were separated by combat areas.

The magnitude of the work of the Central Agency may be gauged from the fact that by 30th June 1947 there were 36,000,000 cards in its indexes and that 54,500,000 mail items had been received and 54,400,000 mail items dispatched. Mail items dispatched included nearly 24,000,000 25-word messages. Of the 36,000,000 index cards, 1,811,000 were for British Commonwealth troops. No separate Australian figures are available. The institution of inquiries was one of the principal activities of the Central Agency: where the index cards did not provide the required information the agency, instead of waiting for such information to arrive, itself began inquiries about prisoners of war, tapping such varied sources as the International Committee of the Red Cross, delegates abroad, camp leaders, camp commandants, chaplains and doctors, prisoners of war in camp, repatriated or shipwrecked prisoners of war, or refugees. When a prisoner of war became anxious through lack of news of his relatives, inquiries were made through official bureaus, institutions, municipal authorities, national Red Cross Societies and so forth.

Relief Supplies. The immense scale of the relief work for prisoners of war is not easy to assess. During the war of 1914-18 it was possible to forward most of the foodstuffs for prisoners of war by parcel post and it might have been assumed that similar conditions would prevail in the war of 1939-45. The Convention of 1929, moreover, laid down the right of prisoners to receive parcels by post; and by putting prisoners in respect of rations on the same basis as "depot troops" of the detaining Power and by laying upon that Power the obligation to supply clothing and medical requirements, that Convention, in principle, assured the basic needs of prisoners.

These expectations were invalidated, however, by two main factors: the unprecedented number of prisoners involved; and the inability, and at times reluctance, of Germany and Italy to meet their commitments under the Convention, because of economic difficulties, and the internal chaos, caused principally by Allied bombing. The result was that a huge burden

was thrown upon all organisations, State and private, who wished to augment the rations and other requirements of prisoners. Existing war conditions forced nearly all donor bodies to rely on the organisation of the International Committee of the Red Cross for the delivery of relief supplies to their various destinations, and this at a time when the committee itself was beset with mounting difficulties. Thus the scheme which, in the minds of the framers of the Convention of 1929, was to provide only occasional relief, became for millions of prisoners the main source of their subsistence and by far the most important aspect of Red Cross work for prisoners of war.

At the outset of the 1939-45 War the system of individual 5-kilo[2] packages of food addressed to prisoners by name was adopted as in 1914-18, but this was found inadequate and from the autumn of 1940 the International Committee of the Red Cross, with the support of its delegates, camp commandants, camp leaders and the prisoners themselves, recommended that the donor organisations send their relief supplies in the form of collective consignments.

These consignments were usually the standard 5-kilo unaddressed parcels sent in cases—the cases themselves proving invaluable to the prisoners for making furniture or as firewood. Bales of foodstuffs, clothing and underwear in bulk were also sent to the International Committee of the Red Cross, and these goods were forwarded from Geneva, carriage-free by rail, to a camp leader of each nationality, who held a stock in reserve and issued them according to need. Bulk consignments could only be sent on behalf of a national Red Cross Society recognised by the opposite side.

The British Government and Red Cross Society had decided to send relief of identical weight and quality to citizens of all countries of the Commonwealth, and the Australian Red Cross, in common with the societies in other parts of the Commonwealth, arranged with the British Red Cross to supply similar standard parcels. Parcels were packed in most Commonwealth countries and in the Argentine. Few parcels for collective consignments were packed in Australia. The Australian authorities arranged with the British Government for parcels to Australian prisoners of war to be supplied from the general pool. The Australian Red Cross in 1944 supplied sheepskin coats, the intention being that each British prisoner of war should receive one.

Suspension of direct postal services between Germany and Switzerland in 1945 and difficulty in obtaining rolling stock for the movement of consignments brought much hardship to prisoners in western Europe who were dependent at this stage almost entirely on food parcels for existence. The International Committee of the Red Cross, however, made strenuous endeavours to alleviate their plight and, with the approval of the Germans, established large stocks of parcels at points in the concentration areas, whence convoys of motor lorries driven by volunteers delivered parcels to camps or to the columns of prisoners who were then being marched across Germany away from the invading armies.

[2] 11 lb avoirdupois.

Improvement of Treatment of Prisoners-of-War. This covered all the enterprises that the International Committee of the Red Cross felt itself bound to institute for the welfare of prisoners of war and to enable the carrying out of the Convention of 1929. By a systematic scheme of visits by delegates of the I.C.R.C. to prisoner-of-war and internment camps, the committee was kept informed of conditions, the need for intervention and the necessity for relief measures at individual camps. The I.C.R.C. was the only body which had the right to visit prisoner-of-war camps of both sides and so was in a position to compare conditions, and to collect authentic evidence for negotiations on behalf of prisoners and internees based on the principle of reciprocity—an important factor in the eyes of belligerent nations.

The observations of these visiting delegates were contained in reports to the International Committee of the Red Cross, copies of which were also sent to the Power to which prisoners belonged. The reports covered a wide range of subjects and included a general description of each camp visited, its position and layout; its capacity, with a stress on overcrowding if present; washing, bathing and toilet facilities; sickness; medical and dental attention available; hospital accommodation; quality and quantity of clothing in the prisoners' possession; laundry facilities; receipt of food parcels and mail; hygiene; working conditions, with particular attention to the amount of food issued to prisoners of war engaged in arduous pursuits and the employment of prisoners exempted from work under the Conventions; payment for work; facilities for religious worship; recreation and exercise; complaints from prisoners and more particularly from the camp leader, whom they were entitled to interview without witnesses; and a general impression of the camp and its routine. In many instances the delegates were able by tactful approach to the camp authorities to remedy deficiencies or obtain concessions on the spot. In other cases intervention was sought through Geneva and the Protecting Power (Switzerland). The delegates were particularly concerned if there had been reprisals and made every effort—sometimes involving protracted negotiations at the highest level—to have retaliatory punishment abolished.

Delegates of the International Committee of the Red Cross were appointed in Germany and Italy, at Tokyo, Shanghai and Hong Kong. These delegates were permitted to visit camps in the European zone and some camps in Korea, Japan, Manchuria, China and Formosa, but despite repeated requests the Japanese would not agree to the appointment or recognition of delegates to areas under Japanese military occupation where the greatest numbers of Australians were held.

Repatriation of Prisoners. A model draft agreement annexed to *Article 68* of the Convention of 1929 provided for the exchange between belligerent Powers of seriously wounded and seriously ill prisoners. In response to a memorandum of the I.C.R.C. in October 1939 the British, French and German Governments intimated that they would, subject to reciprocity, apply the model draft agreement without amendment. In July 1940 the International Committee of the Red Cross initiated negotiations

through the Swiss Government as Protecting Power for the exchange of prisoners of war between Great Britain and Germany, but failure to obtain full agreement between the two belligerent Powers caused delays until October 1941, when an exchange was actually arranged to take place at Dieppe. This was cancelled at the last moment—some of the repatriates were already in transit to the port of exchange—when the Germans demanded that the exchange be on a *per capita* basis. This disappointment and other delays had serious effects on the morale and health of sick and wounded, which the I.C.R.C. made strenuous efforts to offset by dispatching artificial limbs and arranging handicrafts for those awaiting repatriation.

After earnest representations by the I.C.R.C. the Germans in 1942 began the repatriation of Yugoslav sick and wounded, and in April of that year the first exchange of disabled prisoners of war between Great Britain and Italy took place at Smyrna. Three further exchanges between these two countries were made in 1943, but the fifth, arranged for September 1943, was upset by the Italian armistice; the British prisoners of war were eventually sent to Germany, and the Italians to Algiers, whence they later reached their own country. The first repatriation effected between Great Britain and Germany took place in October 1943 at three ports—Gothenburg, Barcelona and Oran—over 5,000 each of Allied and German prisoners being involved. In this exchange, as in the preceding ones between Great Britain and Italy, the cooperation of the International Committee of the Red Cross was only required at and between the ports of assembly but in later exchanges the delegates in some instances accompanied the repatriates from the beginning of their journey. At the ports of embarkation necessities and ample comforts were issued to the repatriates by the Red Cross of the countries where the exchanges took place.

The I.C.R.C. encountered its most serious difficulties in countries under Japanese domination, mainly because of the ancient Japanese conviction that to become a prisoner was degrading. That the Japanese cared little about the fate of their own nationals in enemy hands and that they held prisoners in the ratio of 16 to one, meant that little could be achieved by reciprocity. Japan had signed the two Geneva Conventions of July 1929: one concerning the relief of wounded and sick in the field, and the other the treatment of prisoners of war, but while she had ratified the first she had not ratified the second.

Discipline in the Japanese Army was severe, and the rations of the Japanese soldier were much smaller than those of the Allies. Furthermore there was a vast contrast between general standards of living in Japan and those in Western countries. These circumstances led to the fear that the outlook of Allied prisoners in Japanese hands would be bleak indeed.

At the outbreak of war with Japan the I.C.R.C. invited the Governments of Great Britain, America and Japan to send information about prisoners of war to the Central Prisoner of War Agency at Geneva, and favourable replies were received from each of the belligerents; but despite frequent inquiries the I.C.R.C. could not ascertain the policy of the Jap-

anese Government towards the treatment of prisoners until February 1942, when the Japanese Legation at Berne stated that its Government had not ratified the Convention of 1929 and was therefore not bound by its conditions. Nevertheless it intended, as far as possible, to apply the Convention to all prisoners of war, taking into consideration the customs of each nation and race in respect of food and clothing, and intended also to apply the same conditions to internees, subject to reciprocity. This reply gave the I.C.R.C. the hope that its work could be carried out under similar conditions to those prevailing in other theatres of war. This hope was not, however, realised, because of the Japanese temperament and their method of waging war. All foreigners were mistrusted and even suspected of espionage. The delegates appointed in Borneo before the occupation of that island by the Japanese, Dr Matthaeus Fischer and his wife, were not officially recognised and finally were arrested in May 1943 and charged, sentenced and executed in December of that year. One of the charges against them was that they had "criminally" sought to learn not only the number of prisoners of war and internees in Borneo but also their names, age, race and condition of health, and had tried to send them food.

In Japan, the Japanese Red Cross, in spite of its good intentions, was hampered by the military authorities, but there is evidence that more relief was distributed to prisoners of war in Japan itself than in any other area controlled by the Japanese, with the possible exception of Korea. The prisoner-of-war information bureau set up in Tokyo was uncooperative, and relations with this bureau were very difficult throughout the war.

A delegate of the International Committee of the Red Cross to Japan was approved by the Japanese authorities in January 1942, and later a Swiss resident in Japan was appointed to assist him. The I.C.R.C., with the approval of the local authorities, had appointed delegates not only in Borneo but at Singapore and in Java and Sumatra before the Japanese occupation; in the very early stages of occupation it had tried to obtain Japanese acceptance of these delegates and official recognition of delegates at Shanghai, Hong Kong, and in Thailand and the Philippines. Recognition of the delegates at Shanghai and Hong Kong was received, but withheld for the other areas; the Japanese reply to repeated requests of the I.C.R.C. invariably was that "the time was not yet come". The delegate at Singapore was accepted only at the time of the capitulation of Japan, but he had in the meantime been able to carry out a certain amount of work in a more or less private capacity. The situation remained unchanged in the Philippines until the liberation of those islands, and until the cease-fire in the other areas.

Visits to camps by the I.C.R.C. delegates were forbidden by the Japanese, except in Japan, Formosa, Korea and Manchuria, and, in these countries, because of the ill-will of the Japanese, only 42 of the 102 camps known to exist could be visited. Many obstacles were encountered during the visits: it was impolitic to mention the Geneva Convention, as this infuriated the Japanese military authorities; the duration of the visit was generally restricted to two hours—one hour for conversation with the

camp commandant, 30 minutes for inspection of quarters and 30 minutes for an interview, in the presence of Japanese officers, with a camp leader chosen by the Japanese. No communication with other prisoners was allowed. Not surprisingly, the visits achieved little.

As early as December 1941 the British Red Cross asked the International Committee of the Red Cross to organise relief supplies in the Pacific, and the Australian Red Cross for its part undertook to provide the first relief supplies from the south, provided it could have a neutral ship, escorted, and marked with the distinctive emblem of the I.C.R.C. These and subsequent requests, because of delay in replies from Tokyo and the difficulty of finding suitable neutral shipping, came to nothing until November 1944 when a Japanese ship, the *Hakusan Maru,* went to Siberia to pick up part of a cargo of relief supplies sent there by the United States on a Russian ship. This consignment was of 2,000 tons of goods which included 74,364 parcels. Hopes that this consignment was the forerunner of similar shipments were dashed when the *Awa Maru,* a Japanese ship being used to distribute the cargo of the *Hakusan Maru* to occupied territories, was sunk in April 1945 by an American submarine. Thenceforward, the Japanese Government refused to consider any requests that Red Cross ships should ply in the Far East, and persisted in this attitude to the end.

Previously, in March 1942, it had been suggested by the International Committee's delegation in Japan that Allied ships carrying food and medical stores should be sent to Lourenco Marques in Mozambique, where Japanese ships would pick up the cargo for distribution by the Japanese Red Cross. In July 1942 the Japanese ship *Asama Maru* went to Lourenco Marques to meet the *Gripsholm* and took back 6,993 parcels to Japan or occupied territories. A second exchange took place in September 1942 when the consignment included 48,818 parcels which were unloaded at Singapore—60 per cent were intended for Malaya and 40 per cent for Java. These, however, were never issued on that island, the I.C.R.C. representative being informed in reply to repeated inquiries that "all instructions for the distribution of these supplies had been given direct by Tokyo to the military authorities who took delivery of the parcels". A third exchange in October 1944 carried 47,210 parcels, of which 32,040 were unloaded at Hong Kong and later a further consignment of 48,760 parcels was picked up by the *Teia Maru.* Delegates of the International Committee of the Red Cross were never able to supervise properly the unloading or issue of these relief supplies, and very seldom were they able even to be present on such occasions. The sinking of the *Awa Maru* also ended this source of supply and after November 1944 no further consignments were allowed by the Japanese. In all 225,000 parcels were dispatched to the Far East for distribution among prisoners of war and civilians irrespective of nationality, as the British, American and Dutch Governments had decided to pool relief supplies to this theatre. Actually the number issued to the intended recipients by the Japanese was infinitesimal. There is repeated evidence that the contents of the majority

of the parcels were improperly consumed by members of the Japanese Army, chiefly officers. In some instances contents not attractive to Japanese tastes were given to prisoners as prizes or as incentives to work harder.

In these circumstances, it became necessary to use, for the local purchase of supplies, funds which were intended for supplementary relief arrangements. The equivalent of 21,000,000 Swiss francs, supplied by the Allied Governments and Red Cross Societies, were forwarded to the Far East for local purchases and 16,000,000 were spent by delegates or agents on relief supplies. Five million francs never reached their destination. Of the agents of the I.C.R.C. in Japanese-occupied territories, those in Thailand and Singapore were able to distribute some relief in the face of much opposition by the Japanese, but in the Netherlands East Indies, the activities of agents were suppressed until hostilities ended, when Japanese cooperation was profuse.

Although Japan was not a party to the Convention of 1929 relating to prisoners of war the I.C.R.C. in February 1944 approached the Japanese Government and the other Governments concerned on the question of the repatriation of sick and wounded prisoners of war and internees. No reply was received from Japan. In June the Committee again made representations to Japan, proposing a reciprocal agreement between the Governments concerned on repatriation, particularly for those whose health might deteriorate on account of the climate and, pending the adoption of the agreement, asking that prisoners be transferred to areas where the climate was better and offering to supply all the medical relief necessary for these men. In October a reply was received. This stated that practical difficulties precluded the repatriation of sick and wounded, but that, even so, the Japanese Government was giving attention to the question of transfer to better climates; it added that, as far as they could, the authorities were distributing the necessary medical relief, while the proposal of the International Committee of the Red Cross to supply such relief was still under consideration. In March 1945 a note on the same subject was again sent to the Japanese Government but, in June, when a mission left Geneva for Tokyo, the question remained unresolved.

Negotiations for the release of medical personnel had been similarly abortive. Such personnel had on occasions been repatriated from European prison camps, and demands were made on the Japanese to release senior medical officers captured in Malaya who could be spared from their duties in the camps.

Considerable differences of opinion existed at the time between medical captives themselves; some believed that such officers should be repatriated; others felt that all available medical personnel were necessary for the proper care of the sick and wounded. No concerted steps were taken, and, although several medical officers applied for repatriation, no action followed.

While German captors were cooperative to a certain point, the Japanese largely disregarded all legal and humanitarian obligations. The story of the treatment of prisoners of war in Burma, Thailand and Malaya

needs no detailed repetition here. A full narrative is to be found in *Middle East and Far East,* in this series. There were, however, notable exceptions to the pattern of inhuman behaviour, and some individual officers were helpful and cooperative when their aid was sought in matters relating to prisoners.

Repatriation of enemy prisoners from Australia. Prisoners of war recommended for repatriation from Australia included some who were ill as well as medical men whose services were not needed for the medical care and attention of their compatriots. A special agreement had also been entered into with the Italian authorities by which certain age groups were specially considered, in particular on certain medical and compassionate grounds.

The numbers of prisoners held in Australia at 31st August 1945 were as follows:

	Officers	Other Ranks
German . .	149	1,419
Italian . .	357	16,675
Japanese . .	121	5,127

These figures include enemy merchant seamen. The numbers repatriated to 31st August 1945 were:

	Officers	Other Ranks
Italian . .	264	1,076
German . .	15	51

At this time there were considerable delays owing to shortage of ships. The same cause limited the number of prisoners of war received by Australia from the Middle East, in conformity with an agreement with the United Kingdom. Originally 50,000 prisoners in this category were to be held in Australia, but only 6,000 were transferred, though some 13,000 were later brought from India for employment in Australia.

Selected Italian prisoners were approved for work on farms and in other rural occupations, and a few Germans for work near camps. Almost 1,000 Formosans were employed in New Guinea in labour detachments. Until the end of the war the remainder of the Japanese prisoners were not employed outside but were kept in wired compounds.

It is difficult to draw definite conclusions from these brief observations, but it would seem that more detailed study would indicate at least the general adherence of participants in the war to a pattern of conduct. The cynic might suggest that awareness of the increasing power and speed of engines of war will make this adherence more strict in future. Perhaps there are already some evidences of the cautionary effect of the armaments and weapons of today.

International Law, even if not always codified, has great force and weight, and goes part of the way at least in setting moral as well as legal standards. If the prospect before us has its dark side, there is surely a brighter one, for the light of the full support of Geneva and all it stands for shines on the dangerous path of those who seek peace.

CHAPTER 40

REHABILITATION

JUST as the teaching and practice of plastic surgery have affected the outlook on traumatic and other branches of surgery, so the ideals of rehabilitation have influenced the treatment of all forms of disease and injury. It has been said with truth that diversional and vocational activities, though important, deal only with part of the problem, as rehabilitation must be aimed at the whole man.

Special problems were presented by certain types of disability, such as orthopaedic and psychiatric ones, or those affecting the general physical condition or the special senses. Many patients were retained for considerable periods in orthopaedic wards of general hospitals or in hospitals chiefly or solely dealing with orthopaedic cases, such as Frankston (later transferred to Toowoomba). Occupational therapy and vocational and educational guidance were available there, and when the end of the war drew near it was evident that the Services—the army in particular—would have to retain the responsibility of caring for such patients until the medical mechanism of repatriation could undertake the great task involved. The special case of men who had suffered the loss of a limb or limbs will be referred to later. They needed after-care and training and the close attention of a skilled team. Tuberculosis offered a similar though not identical problem, as there was usually a coexistent pathological process at work, not merely an end state, but a smouldering activity of the infective agent in a usually vulnerable anatomical environment.

The special senses constituted an individual problem, in particular when sight was seriously diminished. Here the condition to be dealt with was not merely loss of vision, wholly or in part, for social and emotional factors were involved as well as the educational and occupational aspects. Chronic or relapsing dermatoses also had important psychological accompaniments, and, when allied to characteristic personality changes, as in allergic states, the problems were much more than skin deep.

Psychiatric rehabilitation, which was more or less concerned in the recovery from most illnesses, was another important problem, and will be discussed more fully later on. It may be said here that psychiatry was only slowly established in the Australian Services during the war, owing in part to paucity of trained staff. However, knowledge grew of the various factors—those related to the common stresses of life as well as others intrinsic to service with the armed forces—which are concerned with the neuro-psychiatric illnesses occurring during war. It was also clearly established that to treat such illness help was required from a number of specially trained persons. The physician, the clinical psychologist, the psychiatrist and the trained social worker constitute a team which should work in conjunction with informed and sympathetic employers. Hardly

less important are the psychosomatic disorders, in which physical treatment, often of an heroic kind, still tends to dominate the therapeutic field.

Rehabilitation in the Army. After 1943 the magnitude of military needs made the return of discharged men to active useful work a pressing problem, and a medical rehabilitation officer, Lieut-Colonel J. B. D. Galbraith, was appointed to coordinate the medical rehabilitation service of the army.

Medical rehabilitation of men returning to civil life was firstly a problem of hospitals, since most of those with significant disabilities, physical or mental, had been or still were under medical review. In addition there were men in whom some condition was found during the final medical board's examination on discharge. The early start of rehabilitation was assisted by the appointment of a rehabilitation officer in each hospital, who combined general hospital work with the task of coordinating those other activities designed to fit the patient for such duties as he would eventually be capable of performing.

The interval between hospitalisation, when the patient needed full medical treatment, and the time of recovery, when he would be able to resume normal, active work, was bridged by the convalescent depots or rehabilitation units, as they were more aptly called in the British and Australian air forces.

In order to relieve the strain on the general hospitals the convalescent depots provided a certain amount of medical treatment, particularly for orthopaedic patients, but this was not their main purpose, which was the physical and psychological preparation of the patient for his return to duty, the former chiefly by means of physical training and hardening courses. The number of medical personnel on the staff was therefore small in comparison to the much larger number of non-medical personnel. It was possible to occupy an orthopaedic patient's time more fully in a depot than in a hospital: in hospital he played a purely passive role with many people to look after him and was restricted by the minimum of army regulations; in the convalescent depot he took an active part in his cure, and was also subjected to military discipline. Later it was found that it was more economical to keep orthopaedic patients in convalescent depots than in hospitals, and the scope and equipment of the depots were increased and good physiotherapy facilities and orthopaedic supervision were developed.

Patients marching into the depots were divided into companies, each with its own self-contained area and organisation, and the companies were broken up into small units or sections. Emphasis was put on comfort and on pleasant surroundings. Some of the patients were able to live in huts, although all spent some time in tents before marching out to their units. The standard of cooking and messing was high, and the mess rooms were made attractive with brightly coloured posters, and, with the help of the Red Cross Society, some attention was given to table appointments. Facilities, such as the large recreation huts, arts and crafts room, workshop, gymnasium, education and study room and regimental aid post,

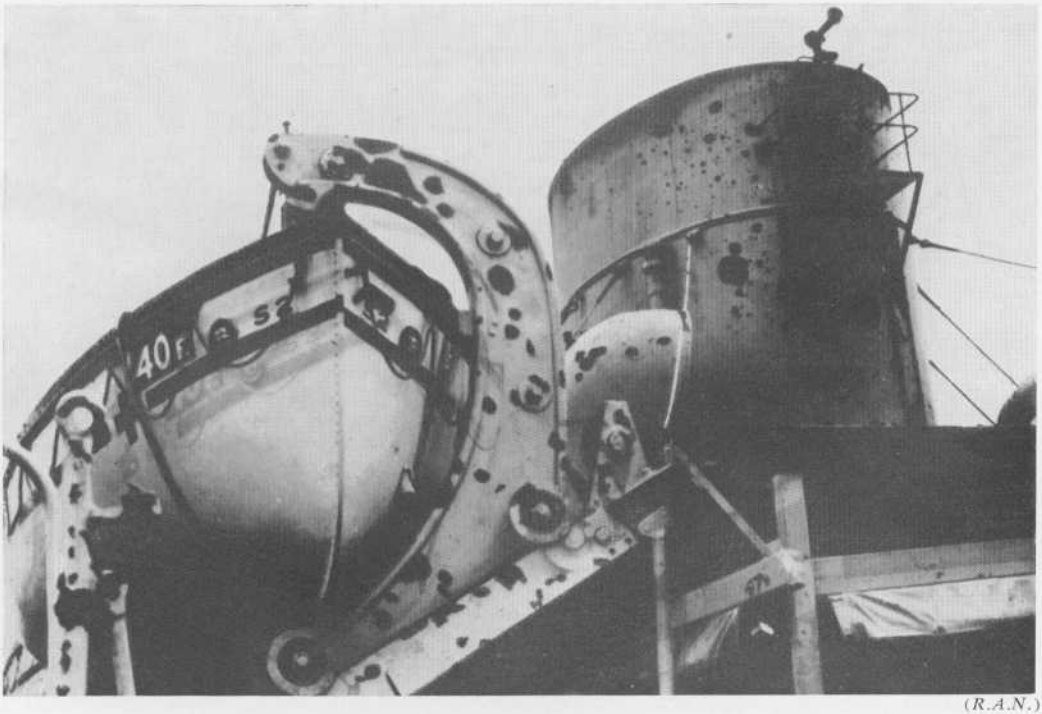
were used by all companies jointly. A large outdoor section was provided for games, recreation and training, and for vegetable gardens.

A military atmosphere was maintained by insistence on high standards of dress and conduct, and on punctuality at reveille and at all parades, including dress parades. But in spite of the constraints of army routine, the patient was treated as an individual, and encouraged to take his personal and family problems to his officers or to the chaplain or rehabilitation officer.

Patients in the depots fell into two main categories: those who were class "A" medically before their injury and who would be class "A" again after recovery; and those who would in future, because of illness or injury be only class "B" after recovery. The first group presented no problem. The second group required a great deal of study, and the depot could do much for them. In an official army brochure on the work of the depots published in 1943 it was pointed out that while a convalescent was in a depot it was not enough to assess his physical disabilities; a decision should also be made on the best way to employ him for the war effort, either within or without the armed Services. The earlier such a decision was taken the more effective would be his recovery, both physically and psychologically. Elsewhere it has been remarked that during the early years in the Middle East, especially during busy periods, numbers of men were caught in the ebb and flow of a tide which bore them in alternation to and from hospital and convalescent depot. Obviously only an attempt to assess the true condition of these men from all aspects would restore them to full usefulness.

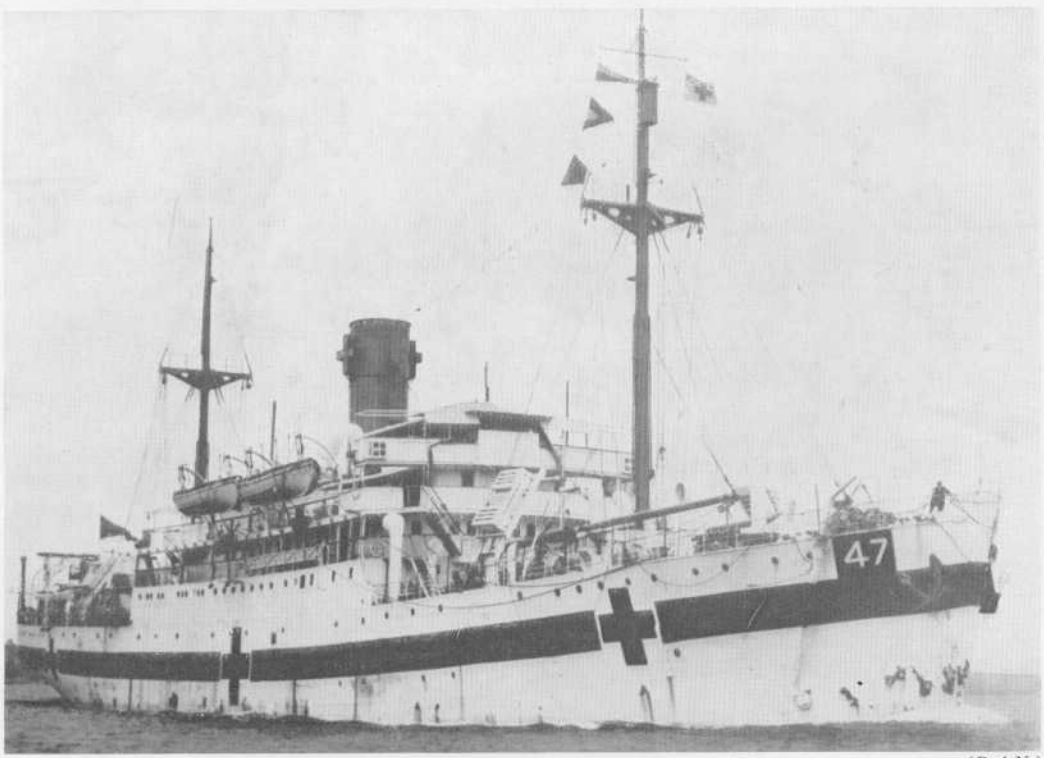
After the degree of disability had been assessed and the convalescent's talents estimated by a series of tests it was possible to help him to decide what work he would take up and then to give him a certain amount of education and training. His program was carefully worked out and he was kept to a strict time-table, which included study, physical training, arts and crafts, games and recreation. An education officer arranged correspondence courses, and provided a good reference and technical library. In well-equipped workshops therapy was provided for the men with physical disabilities and training for disabled men. Physical training varied with medical needs, and was designed to correct disabilities, to improve the physique of under-developed recruits, and to provide general exercise for convalescents, gradually working up from light training to strenuous full training. Arts and crafts were a pleasant method of exercise for men with atrophied muscles, for which it was difficult to find remedial exercises, and an enjoyable occupation for others who had no need of remedial exercises. Games were played at specified times and under the supervision of a non-commissioned officer.

By the time he left the convalescent depot a soldier had gained in a number of ways, not the least important of which was the psychological gain of knowing that he was regarded as an important and useful member of the community, and that he could look forward to a useful and congenial job.



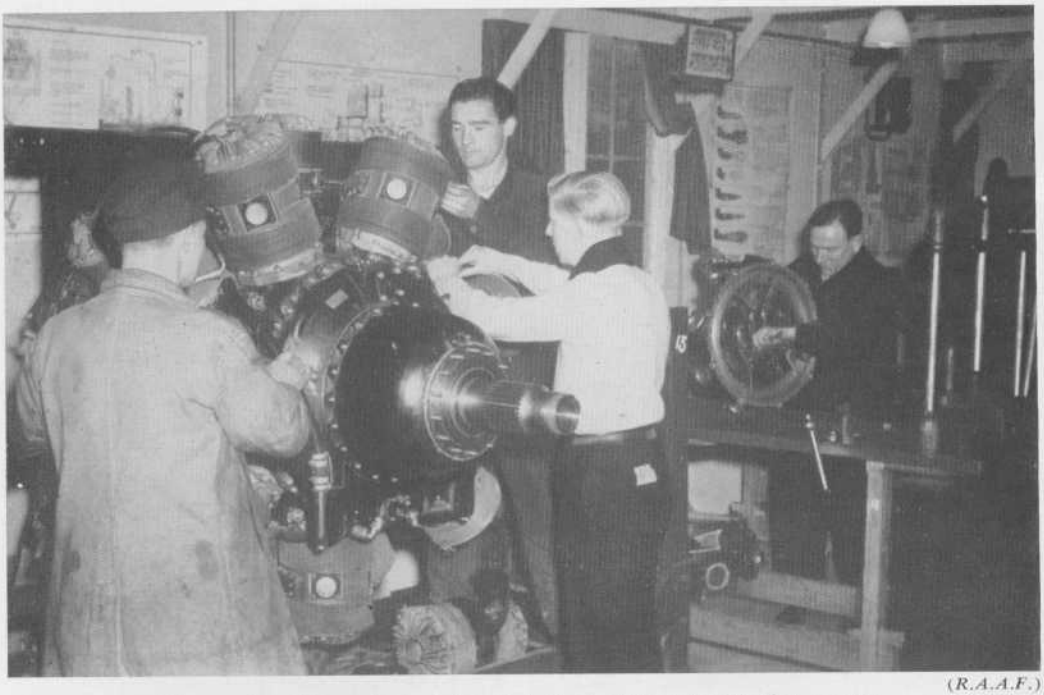
(*R.A.N.*)

Manunda, showing damage inflicted during the Japanese air attack on Darwin, 19th February 1942.



(*R.A.N.*)

The Australian hospital ship *Centaur,* which was sunk by a Japanese submarine off the Queensland coast on 14th May 1943.



(*R.A.A.F.*)

The engine fitting shop at the R.A.F. medical rehabilitation centre, Loughborough, England.



(*R.A.A.F.*)

R.A.A.F. medical rehabilitation at Jervis Bay.

Repatriated prisoners of war. The returning prisoner, or repatriate as he was designated, was given special consideration by the Rehabilitation Section of the army, and to help in his re-orientation an officer of the section was attached to each prisoner-of-war reception group.

For administrative purposes repatriates were divided into three groups: sick and wounded needing further hospital or medical treatment; those who, although otherwise physically fit, had been left by their experience with some degree of temporary or permanent unbalance; those who were physically and mentally normal. On disembarkation the sick and wounded were sent to hospital, and the rest were marched into the general dispersal depot where a separate area of the camp had been set aside for them.

Whenever practicable medical examinations had been carried out during and at the end of the voyage to Australia. On disembarkation the men were again examined to make sure they could not pass on infection to their families. This examination consisted of chest X-rays, blood films for detection of malaria parasites and, where symptoms suggested the need, tests for intestinal infections. They were also vaccinated against smallpox and given instructions for taking atebrin. Those not needing immediate hospital or convalescent treatment were given 21 days' leave. After their return from leave they were medically boarded, told the results of the board (unless for medical reasons this was thought inadvisable), reassured as far as possible as to their state of health, and given any advice that was necessary. If a repatriate did not need medical or dental treatment or psychological adjustment, and had no social, domestic, employment or training problems that could not be solved within a few days, he was immediately demobilised. Otherwise he was admitted to a convalescent depot or other suitable establishment, unless it was decided (as it often was in the case of psychological or psychiatric disability) that he would make more progress if treated as an out-patient. In that case he was given a period of therapeutic leave.

The stay of the former prisoner of war in the convalescent depot was carefully planned and an effort was made to persuade him that the program had a definite purpose and was not simply a series of diversions. No pains were spared to see that he was as comfortable as possible; his clothing was replaced quickly and generously; plenty of sporting equipment was provided, and his diet was arranged to provide the most valuable elements for restoring him to health and vigour without being too bulky for the capacity of men with poor appetites. Physical training was stepped up more gradually than in the case of normal convalescents. A good deal of time was devoted to bringing the men up to date on current affairs and local developments, and to explaining demobilisation procedure and post-war reconstruction plans. Before he was discharged each former prisoner was visited by the army rehabilitation officer and his staff, and the matter of his re-establishment in civil life was discussed.

The Red Cross Society, which was likely to have won the thanks and regard of the prisoner by the help it had given him and his family during

his time in captivity, continued to provide comforts and some of his supplies while he was in hospital or convalescent depot.[1]

Medical examination and final boarding before demobilisation. Medical examination of all men about to be discharged was done within their units. Each one had a micro-radiographical X-ray, and if any defect was observed, a further large X-ray and a clinical investigation were made before he was presented for final medical board. Specialists could be called upon for consultation on disorders of the eye, ear, nose and throat, and skin, and on orthopaedics and psychiatry. If no disability was revealed at the time or by X-ray, this was the final boarding. If specialist opinion was necessary, it was obtained where possible in the formation area, but in any case before final medical boarding. Some 600 servicemen and women were boarded daily, of whom about 200 needed final medical board. Each final medical board consisted of three medical officers, and dealt with 14 or 15 men a day if possible. However, it was emphasised that this board was the last opportunity to determine the exact medical condition of the soldier at discharge, and that thoroughness must be maintained in the interests of the soldier and of the community. It was often necessary to have specialist investigations done, and medical officers were instructed that these should never be neglected in an endeavour to get through the average number of cases. The process was a tedious one because a true appraisal of each soldier was possible only after his file—often pages of illegible and faded handwriting—had been carefully searched.

Close at hand, to avoid unnecessary movement, were Service rehabilitation and vocational guidance sections, which were rationed and quartered in Service discharge depots.

Rehabilitation in the R.A.F. and the R.A.A.F. In Britain manpower shortages had given impetus to the formation within the Emergency Medical Service of a rehabilitation service under which disabled persons were taught new trades and skills. The service had been pioneered by such organisations as the Robert Jones Curative Workshops for disabled soldiers, which were established towards the end of the war of 1914-18 and which continued to function for a short time after; the Robert Jones and Agnes Hunt "Derwen Cripples Centre" at Oswestry, which provided treatment and vocational training and which functioned in relation to the Oswestry Orthopaedic Hospital; and by various services for workers such as that established at Crewe by Dr H. E. Moore for the London, Midland and Scottish Railway Company workers, and that established at Motherwell near Glasgow by Mr A. Miller for disabled dockworkers.

Early in 1940 Sir Reginald Watson-Jones, who for ten years before the war had striven without success to introduce properly organised rehabilitation centres for fracture cases, was appointed civilian consultant

[1] Most of the material in this section was taken from "Instructions on Medical Rehabilitation Procedure for A.I.F. Personnel Repatriated, or Returned, to Australia from Enemy, etc, Custody", 211/4/430, 5 Oct 1945.

in orthopaedic surgery to the Royal Air Force. With the approval of the Director-General of Medical Services of the R.A.F., Air Marshal Sir Harold Whittingham, Watson-Jones introduced a complete orthopaedic rehabilitation service, which eventually was to consist of ten orthopaedic hospitals and five special rehabilitation centres.

Men with minor orthopaedic disabilities were not sent to the special centres but completed their treatment at the orthopaedic hospitals. Each such hospital was under the control of an orthopaedic surgeon of senior rank, who had one or two other surgeons to help him. Medical orderlies were trained as rehabilitation orderlies. Sometimes jocularly referred to as "muscle mechanics", they supervised remedial exercises, ensuring that each patient did some exercise every hour. They also encouraged occupational pursuits, organised light indoor games, and generally promoted a happy and cheerful atmosphere in the wards. In some R.A.F. orthopaedic hospitals physiotherapists supervised the remedial exercises. More serious cases were transferred to special centres to complete their treatment. The work of the orthopaedic hospitals and the special centres was coordinated by consultant surgeons, who visited both types of institution regularly.

The centres were equipped with gymnasiums, playing fields, tennis and volley-ball courts, and swimming pools. There, away from the hospital atmosphere, the germ of chronic invalidism could be more easily attacked. In one centre officers were treated, in another aircrew N.C.O's, in a third skilled ground-staff and, in another two, unskilled ground staff. This arrangement made for easy control, reducing administrative and disciplinary problems to a minimum.

The medical officer, after assessing each patient, prescribed a daily program of activity and rest. In addition to supervising this activity he took part in it, working in the gymnasium and on the playing field and the swimming pool side by side with his patients. Where necessary he gave pep talks to encourage progress.

Physiotherapists, occupational therapists and physical training instructors or gymnasts worked under the medical officer. The physiotherapists had to possess their diploma of the Chartered Society of Physiotherapists, and the occupational therapists to be graduates of a recognised school of occupational therapy.

The physical training instructors were chosen from suitable trainees of the initial physical and recreational training courses. A representative from the rehabilitation centres lectured to groups of trainees at these courses, and volunteers for work at rehabilitation centres were called for. These volunteers were sent to various centres where they were kept under observation by the commanding officer, and if they were found suitable and were still interested after a three-months trial period, they were given an advanced course in remedial exercise therapy and then posted to the staff of the centres. Before final selection they had to show that they had a genuine sympathy for and understanding of the psychological reactions of disabled persons. Suitably trained and chosen physical training instructors were invaluable in creating the final degree of physical fitness. They

worked in the gymnasium with the physiotherapists and under the medical officer's direction.

The day was arranged for each patient so that he was given specific and general exercise as well as rest. Specific exercise was in the form of remedial exercise and remedial occupational therapy. General exercise included various grades of physical training and games of all types, some chosen for their remedial value and others for purely recreational purposes.

In addition to daily supervision by medical officers, patients were reviewed weekly and their progress assessed. When maximum recovery had been reached, they were medically boarded for disposal within the Service or for discharge. The aim of the treatment from the time of injury was to return the patient to his final physical capabilities. If a man had to be discharged, a social rehabilitation service existed to ensure his re-training and re-settlement in industry. Special re-training centres organised by the Ministry of Labour and National Service were available for the re-training of ex-servicemen.

The total number of in-patients treated at R.A.F. orthopaedic hospitals and special centres from June 1940 to March 1943 was 21,187. The special centres did not open until five months after the hospitals and the total number of admissions to the four major rehabilitation centres in this period was 8,204. The results of the first 13,500 were analysed: 85 per cent of aircrew resumed flying duties; 96 per cent of ground staff returned to duty; less than 5 per cent of officers and airmen were invalided. The first 405 aircrew members to be treated at one special centre were followed up after their discharge to unit, and of these 405 cases 333 (82.2 per cent) returned to flying duties and 72 (17.8 per cent) were permanently grounded. Of the 72 cases grounded 42 were retained in the Service and 30 discharged or repatriated.

During the war other experiments in rehabilitation were carried out in Britain. At a maxillo-facial and plastic surgery unit at East Grinstead, Sussex, Mr A. H. McIndoe, the New Zealand plastic surgeon, made an interesting experiment in the use of occupational therapy. His unit comprised 90 beds, most of which were occupied by air force personnel, mainly aircrew. About 50 per cent of those treated had facial injuries, burns, fractures and soft-tissue defects; 50 per cent had injuries to other parts of the body—skin losses from trauma or other tissue contractures, causing deformity of orthopaedic significance. The problem in the former group was mainly psychological; in the latter restoration of function was paramount.

To provide occupations to meet the needs of these two groups he established a small annexe for the production of aircraft precision instruments: lathes were set up and modern equipment installed. Constant supplies of parts arrived weekly from a factory near by and were assembled by patients under the direction of a skilled technician supplied by the factory, and four girl workers, one of whom stood at each bench as an instructor. To avoid monotony, patients having worked at one operation for a time would move to another bench where a different operation was

being carried out. The work was clean, interesting and of great remedial value, particularly for burnt and crippled hands. In addition, the patients felt that they were doing work of national importance.

A similar idea was developed at the Austin works in England. A workshop was set up where injured workmen employed by the company could complete their recovery and at the same time do productive work. Many of the tools and machines used in assembling motor cars were modified so that they could be used by injured workmen. The plant medical officer worked in close cooperation with the works foreman and with an orthopaedic surgeon to ensure that the workmen used the tools and machines correctly.

In the R.A.A.F. also manpower shortages which occurred after the entry of Japan into the war pointed to the necessity for a rehabilitation scheme whereby skilled aircrew and ground staff who had been admitted to hospital with major surgical, orthopaedic or neuro-psychiatric disabilities could be returned to effective duty as soon as possible. In 1942 convalescent depots, later to be called medical rehabilitation units, were formed in each State to provide a unified program of physiotherapy, occupational therapy, physical training, recreational games, education and resettlement facilities.

The R.A.A.F. had considerable difficulty in getting permission to establish rehabilitation centres of the sort which had been found suitable in the United Kingdom. The insistence on a pleasant situation and comfortable living quarters was regarded as unreasonable, and it was some time before approval was given by the Board of Business Administration for the necessary finance. The first five convalescent depots were formed about October 1942 at Warburton, Victoria; Clydesdale, New South Wales (this unit was later moved to Jervis Bay); Southport, Queensland; Mount Barker, South Australia; and at Yanchep, Western Australia. Others were formed later at Victor Harbor and Mount Spec in Queensland, and also in the Darwin and New Guinea areas where they served the needs of patients convalescing from illnesses or injuries which had not been considered serious enough to require evacuation to a base area. The units varied in size according to the size of the air force community and the air force hospitals for which they catered. The two largest units, at Warburton and Jervis Bay, could each accommodate 250 patients; those at Southport and Victor Harbor 100; and those at Yanchep and Mount Spec 50.

An R.A.A.F. medical officer, Flight Lieutenant G. G. Burniston, while on squadron medical officer duty in the United Kingdom in 1941, attended an orthopaedic course for Service medical officers given by Watson-Jones at the British Post-Graduate Medical School. At Watson-Jones' instigation and with the approval of the D.G.M.S., he was posted for 12 months' duty with R.A.F. rehabilitation units. He went first to the R.A.F. Orthopaedic Rehabilitation Centre at Hoylake, near Liverpool, where there were a number of Australian aircrew N.C.O's, and later to Loughborough and other centres.

Burniston returned to Australia in July 1943. He was attached to No. 1 Convalescent Depot at Warburton, and when No. 2 Convalescent Depot at Clydesdale was transferred to Jervis Bay in January 1944 was placed in command. Both at Warburton and Jervis Bay Burniston helped to introduce a program of rehabilitation which was based on the principles and practice of treatment he had seen demonstrated in the R.A.F. units. A similar program was adopted in the other medical rehabilitation units in Queensland, South Australia and Western Australia.

The R.A.A.F. units, however, differed in some respects from the R.A.F. The R.A.A.F. units did not cater for orthopaedic patients exclusively, although these generally predominated, but took care of all types of medical, surgical and some neuro-psychiatric patients who were in need of supervision during the convalescent period. Again certain departments, such as occupational therapy, were developed more thoroughly in the R.A.A.F. units, which provided varied activities from light handicrafts, such as leather and basket-work, through carpentry, sheet-metal work and wireless telegraphy to animal husbandry. No. 1 M.R.U. at Warburton developed a model farm, where activities included dairy farming, pig raising and poultry farming.

In the R.A.A.F. units a serious attempt was also made to broaden the general education of patients. The education officer controlled such activities as musical appreciation and the special studies which many patients wished to pursue during their stay in the units. He arranged access to libraries, group discussions and film shows. In particular, films were shown of the work being done by Watson-Jones and the industrial rehabilitation centres in Great Britain. These inspired confidence in patients who felt that the physical training was too strenuous and even dangerous while they had limbs in plaster.

Early in 1945 Squadron Leader D. O. Longmuir, the commanding officer of No. 1 M.R.U., was posted to the United Kingdom for a period of six months, so that he might gain information on developments in techniques in R.A.F. medical rehabilitation. During his absence Squadron Leader D. T. Shortridge, who had been attached to the R.A.F. Rehabilitation Service for a short period, was posted to command No. 1 M.R.U.

When the war ended the units were used for the rehabilitation of repatriated R.A.A.F. prisoners of war, as well as disabled airmen who still required rehabilitation. The heavy cost of setting them up was well justified by the results achieved.

Rehabilitation in the Navy. No medical rehabilitation units were set up in the R.A.N., which, when necessary, used the facilities of the other Services and of the Repatriation Commission. In May 1943 rehabilitation officers were appointed in New South Wales in *Kuttabul, Penguin* and *Rushcutter,* in Victoria in *Cerberus* and *Lonsdale,* in Queensland in *Moreton* and *Magnetic,* in South Australia in *Torrens,* and in Tasmania in *Huon.* The Director of Personal Services became Chief Rehabilitation Officer. However, the duties of these officers—dubbed "Goodbye Officers" by the ratings—were confined to liaison work between the navy and the

various authorities outside the Service who assumed responsibility for discharged personnel.

Although rehabilitation was not regarded as a naval responsibility, the navy played its part in inter-Service planning through its representation on the various committees dealing with demobilisation, rehabilitation and post-war training.

Artificial limbs.[2] The first limb factory was established by the Commonwealth in November 1917 at the 11th A.G.H. (which was to become the Repatriation General Hospital), Caulfield, Victoria.

Originally the limbs were made of osier willow. In 1925 the factory was reorganised and equipment was installed to turn out legs of duralumin, a light alloy composed mainly of aluminium, magnesium, copper and manganese. After some experimentation the metal legs made at Caulfield reached as high a standard of comfort and efficiency as any produced in other countries. Factories were later established in Queensland, New South Wales, Western Australia and South Australia, and a repair shop in Tasmania. The men employed in these factories were for the most part returned soldiers, most of whom had lost a limb, and had been trained in artificial limb-making after their return from active service.

As time went on the more useful appliances and features introduced overseas were adopted in Australia. A great deal of attention was given to detail and experiment, to provide each man with the most suitable type of prosthesis for his amputation site and for his occupation. For example, for a countryman who did a lot of riding a leg was devised with a safety stirrup which would release his foot if he fell, so that he would not be dragged along the ground. For the farmer a special leg was made that would be comfortable while walking on irrigated ground. In spite of these refinements some farmers and bush men still preferred the old peg-leg. Limb-making could, then, never be a matter of mass production, and for this reason the output was always limited.

Very few men whose arms had been amputated wore artificial arms. These had little use except for dress purposes, and were always a burden to the wearer, particularly a working arm, which had to be solidly built. It was found that most amputees preferred a hook attached to the arm socket for working purposes. In industry the loss of an arm was regarded as a greater disadvantage than the loss of a leg, and the handicap was felt more keenly. A number of ingenious devices were manufactured to help the wearer of an artificial arm in his work or leisure: an appliance to allow a car driver to grip and release the wheel proved successful; another to enable a billiard-marker to play billiards was also successful; for rural workers and others a working arm was fitted with hooks, swivel rings and vices, and magnets for holding nails before driving them in.

During the year 1944-45 two technicians in the Repatriation artificial limb factories spent six months in Britain, Canada and America studying the latest developments in the design and manufacture of artificial limbs, surgical aids and appliances. They met with complete cooperation from

[2] This section is based on the annual reports of the Repatriation Commission.

government officials and private firms, and were able to bring back a number of improvements in manufacturing methods which were adopted by the commission and contributed to the comfort and efficiency of the appliances.

Two crutch seats were devised and manufactured in Australia. The patent rights of the first were bought by Mr Norman Myer, who undertook to supply the seats free of cost to all limbless ex-soldiers in Victoria and South Australia, through the Limbless Soldiers' Association. Another crutch seat was invented by Mr R. L. Stalker, of Goulburn, New South Wales, who donated the Australian manufacturing rights to the Repatriation Commission for the benefit of Australian limbless soldiers. At first these seats were issued only to soldiers with high thigh or hip amputations who could not wear artificial legs without difficulty, but as more became available their issue was extended to other leg amputees who would find them helpful.

It was not until 1949 that a major development in the design of artificial limbs was adopted in Australia. This was the suction socket, which had originated in Germany many years before and which greatly helped in fitting an artificial leg above the knee; it did away with the need for body harness and for the stump sock. In 1949 Mr W. E. Greenaway and Mr C. R. Boyle of the artificial limb factory in Victoria visited Britain, France, Germany and Sweden and brought back reports and recommendations about suction sockets, with the self-locking knee mechanism (a device for aligning the lower limb prosthesis), and methods of incorporating a rotary movement in suitable above-elbow arms. The difficulties of making and fitting suction sockets were considerable, but the techniques observed overseas were introduced into the Repatriation artificial limb factories.

Two devices designed and made at the Victorian factory in 1953 were a big contribution to efficient production. The first was an "aligning leg", which was attached to the bucket of an above-the-knee amputee during walking tests. It could be adjusted to all necessary movements of the wearer, and so made it possible to ensure correct alignment and fitting before the limb was complete. In effect, it took the guesswork out of limb building. The second device was a jig to provide exact duplication of the adjustments made by the "aligning leg".

An automatic knee-locking device was also developed which gave the wearer of an above-the-knee prosthesis greater security by preventing the sudden flexing of the knee joint when walking on uneven surfaces. A further contribution to the comfort of amputees was the coating of limb sockets and all leather work that came in contact with perspiration, with a nylon solution which was impervious to moisture and permitted the treated surfaces to be washed daily.

A useful aid in rehabilitating the disabled was the moving picture. The Department of Information helped with the preparation of a suitable film, using as a guide the English film *Back to Normal.* This film created a great deal of interest in the industrial world, and one large firm showed

it to its executives and staff in Adelaide and Melbourne; this helped the firm to plan for the reabsorption of those of their employees who had been disabled during the war into jobs similar to those held on enlistment.

War blinded. At an early stage in the war the Commonwealth Government recognised that it should formulate its own plans for assisting those members of the forces who had been robbed of their sight because of war service. These plans were designed primarily to ensure the member's happy return to home life and from that point to teach him how to live and act normally; to implant in his mind that he was still a valuable asset to his country; to inspire him with self-respect and self-reliance; and to instil in his mind that there were many things which he could do as well as a sighted person, and even some that he could do better.

At the same time the Repatriation Commission considered itself bound to arrange for the possibility of members of the forces being blinded, and co-opted the services of Mr P. J. Lynch, Federal President of the Australian Blinded Soldiers' Association; and Mr S. W. Hedger, Superintendent and Secretary of the Royal Victorian Institute for the Blind, to act in an advisory capacity. Both did this work in an honorary capacity.

In each State of the Commonwealth a committee was set up under a chairman appointed by the Government, three of the chairmen being blinded soldiers from the 1914-18 war. These committees assisted the Repatriation Commission by supplying the personal touch, extending hospitality, overseeing training and arranging other assistance. The Commission regarded it as essential that the supervision given to men blinded in the war should be handled exclusively by these committees, while it met the whole cost of training, as well as of the necessary materials, books and other requirements.

In order to assist relatives and friends of war-blinded ex-servicemen, a handbook, *Helping the War Blinded to See,* was published by the Repatriation Commission in May 1942, with a revised edition in July 1945. It was decided that preliminary training of blinded ex-servicemen should be in typewriting, hobbies and Braille. Careful and expert attention was devoted to each case in order to select the most suitable type of further training, which would ultimately result in placing the individual in employment.

On first admission to a general hospital blinded members were given a Braille watch so that they could learn to tell the time and thus start on the road to a new independence. Specially marked dominoes, cards and draughts were then used to help the member to develop his sense of touch and to participate in games with sighted colleagues. Tuition in Braille interspersed with typewriting was the next step.

With the end of the Pacific War and the release of those who had been prisoners of war it was found that, as a result of malnutrition, a considerable number had become affected with retrobulbar neuritis or nutritional amblyopia. While in many such cases the effects on vision were

minimal, the organic damage in others was considerable, and in some cases the disability amounted to the absence of any useful vision.

In the early stages the examination of these former prisoners was undertaken by the army medical services and the early training of those whose vision had been more severely affected was initiated through the rehabilitation officers at the various discharge centres. The Repatriation Department sent Messrs Lynch and Hedger first to Sydney in January 1946 and later to all other States, where they were able to discuss with the representatives of the army, war blinded committees, and local repatriation administration the measures already taken, and advise on further measures.

In April 1946 the Department of the Army notified the Repatriation Commission that it had been decided to segregate the more seriously affected repatriates in three convalescent depots: the Lady Gowrie Convalescent Home, Sydney; Stonnington Convalescent Home, Melbourne; and the Lady Mitchell Convalescent Home, Perth. Other blinded soldiers who had not yet been discharged from the army would also be admitted to these centres. While the army did not consider it advisable that there should be dual control, with the Repatriation Commission becoming responsible for training and welfare, it was prepared to cooperate with the Commission in affording accommodation in these three Red Cross homes for war-blinded personnel who had already been discharged during the period of training, realising that, ultimately, all army personnel would be transferred to the control of the Repatriation Commission.

"Talking books" have been issued to the blinded, and to some who retained useful vision. Issues were made of magnifying glasses, telescopic spectacles and monocular and binocular field glasses.

The psychiatric problem.[3] The high incidence of mental disorders in western countries at the time of the Second World War is shown by some American figures: of 16,000,000 recruits between 20 and 40 years of age, one in 20 was rejected because of neuro-psychiatric disorders; but in spite of this high rate of rejection, 37 per cent of all discharges from the American forces were for neuro-psychiatric conditions.

Dr G. J. M. Saxby has stated that the average number of psychoneurotics was no greater in the Australian Army than in civilian life, and that the number of men who broke down under front-line conditions was very small, mental casualties occurring mainly among the bored and frustrated in safe areas.

The nature of army life tended to destroy a man's individuality and independence, leading to a regression to the immature attitudes of childhood. If he came to feel that the group had failed him, or if he felt a strong reaction to the death of his mates or to hardship, he might then develop a feeling of helplessness associated with anxiety and hostility. This caused him to become introspective, and his emotion might express itself as a tremor, tachycardia, etcetera; or his personality might become

[3] In writing this section use has been made of a letter from Major J. F. Williams to Dr Allan S. Walker, and of the article by Dr Alan Stoller, "Social Work and the Ex-Serviceman: The Psychiatric Problem", in *Medical Journal of Australia*, 14 May 1949.

disorganised and his behaviour highly eccentric. In the case of battle exhaustion the symptoms were mainly physical and responded effectively to sedation; perhaps 20 per cent became clinical cases with anxiety states of all degrees of severity, ranging from conversion hysterias to psychosomatic disorders. Predisposed subjects produced psychotic pictures which were mostly of the paranoid or hebephrenic type, and which usually subsided when they were removed from the combat area; if they were kept at the front line the condition tended to become fixed.

On return to community life the acute disorders usually settled down, with the removal of anxiety and danger, to a state that followed the pattern usually found in civilian society. But in many cases the disorder had awakened trends the subject was unable to deal with, and the abnormal behaviour continued. Often the neurosis was not manifested until after discharge, and was due either to the abrupt change in environment or to the fact that the symptoms had been concealed so that he would be allowed to return home. A subject who might have lived untroubled in civilian life could, after being conditioned to the immature, overprotected life of the army, find himself unable to handle the adult and responsible conditions of civilian life. Psycho-pathological symptoms, similar to but less severe than those found under combat conditions, would then appear. The subject might allow these to become fixed because he could see the value they might have in the form of pensions, though this was by no means as common as was popularly thought. Major A. Stoller's experience was that the thought of a pension had very little influence on the ex-serviceman, whose wish, consciously at any rate, was to get well as quickly as possible. This agreed with the findings of workers in the United States. Alternatively, somatic complaints might persist because they gave the subject an excuse to remain dependent—on his family or on the community. Hostile-aggressive states, common in those whose homes had been disrupted in childhood, often caused subjects to become anti-social and even criminal; this hostility and a tendency to vagrancy made them difficult to manage. Psychosis took many forms, but paranoid forms were commonest in mental conditions.

During the war of 1914-18 it had been found that owing to the respectability of physical, as contrasted with mental, disorders, the mental disorder was frequently translated by conversion hysteria to functional blindness, deafness, mutism, paralysis, and so on. Unfortunately, the shortage of trained psychiatrists at that time made it impossible to use and consolidate the knowledge gained.

By 1939 the clinical syndromes occurring under conditions of war, psycho-pathological mechanisms, and the trends in a personality which predispose it to breakdown, were more clearly understood. It then would have been possible for the clinical psychologist and the psychiatric social worker to play an important part, first in selecting recruits and later in the field of mental hygiene and rehabilitation, but in Australia the role of both these specialists was negligible, at least insofar as selecting recruits was concerned. That there was a high incidence of psychiatric casualties

early in the war was due, in part, to the lack of psychiatric experience of medical officers, and also to the rapid expansion of the Services with the entry of Japan into the war. Numbers of men who should never have been accepted were enlisted and quickly broke down; this condition was aggravated by a sense of guilt and failure, and they often became chronic psychoneurotics.

The organisation of the psychiatric services in the Australian armed forces has been described in Volume I. The standard of psychiatry was not high—much below that in the British, Canadian, American or German forces. Very few trained psychiatrists were available, and the only attempt made during the war to train them consisted of a single four months' course for four army, one navy and three air force officers. The attitude to psychiatrists, even to the most highly trained and experienced, was one of distrust, the official view being that the best psychiatrist was the R.M.O., who was able to detect malingerers and to "bash back" neurotics. There was no attempt in Victoria to use psychiatrists for eliminating recruits who were bad risks psychiatrically until there was trouble between the psychological section and Medical Boards, and a visiting psychiatrist was appointed at the end of 1943. The psychological section was being forced, by lack of psychiatric facilities, to undertake diagnostic work for which it was not fitted but which was urgently needed by the army. This included advising on the suitability of recruits who were mentally dull or had unstable backgrounds, and the examination of soldiers under detention or sentence. When problems of rehabilitation had to be faced, there was a serious lack of psychiatric, as opposed to psychological, advice available—again in contrast with practice in other countries.

Until late in 1945 when full-time psychiatrists were appointed to base hospitals, there were no psychiatrists recognised as such in the A.I.F., though there were a very few "physician specialists" acting as psychiatrists. In a report to the D.G.M.S. in December 1944 Major J. F. Williams stated:

> Psychiatric problems do exist in large numbers and they are poorly dealt with by methods which will inevitably lead to great difficulties in rehabilitation and which are often unjust to the men and unworthy of the standards of the A.A.M.C.

For instance, he found that some 200 assorted psychiatric cases had accumulated at the 7th Camp Hospital, Redbank, and that the only skilled attention they had had in several months had been a weekly visit from Lieut-Colonel B. F. R. Stafford, Superintendent of Goodna Mental Hospital. Civilian psychologists came weekly to conduct psychological tests and give "psychotherapy". Acute psychotic cases were segregated in a special ward at Goodna under poor conditions, but there was little attempt to separate mild psychotic and psychoneurotic patients. Facilities for treating them were negligible, though Red Cross workers and the medical officers had developed some rudimentary occupational therapy and games. Some patients spent months there awaiting boards.

The need for specialised psychiatric attention was underlined by the fact that at the 112th A.G.H. psychiatric cases made up as much as

25 per cent of the total bed state. At the time when the 7th and 9th Divisions of the A.I.F. were recuperating on the Atherton Tableland, no psychiatric opinion was available at the 2/2nd or the 2/6th A.G.H. or at the 2/14th at Townsville. Nothing was being done to weed out the psychiatrically unfit, partly for fear of an avalanche of discharges, but more because of a lack of understanding that it was part of a medical officer's duty to assess any disabilities of intelligence, personality or stability. As a result many neurotics were kept within their units to the advantage of neither the army nor themselves; they were of little use in the units; they constituted a trial to the R.M.O., and being subjected to further strain sometimes developed into psychotics.

The differential diagnosis of the psychotic states was difficult. While half presented a picture of schizophrenia the others were mainly mood swings in the direction of mania or depression. Of the neurotics admitted to 102nd A.G.H., Tamworth, during 1945, about 20 per cent had hysterical colouring but the majority showed fairly definite anxiety symptoms. Mental dullness sufficiently marked to be recognised by R.M.O's was not common (3 per cent) but it was certainly a contributing factor in a large number of cases. Sixteen per cent were regarded as psychopathic personalities of one kind or another. By this time much more interest was being shown in psychiatry, but the nucleus of trained staff was still dismally small, and the R.M.O's who were to have been the first line of defence against psychiatric troubles were still almost completely ignorant of military psychiatry. Williams decided that the maintenance of morale did more than anything else to prevent epidemics of anxiety states, and in this the R.M.O's and combatant officers had a difficult role which would have been made easier by some psychiatric advice. The best way of giving this would have been to tackle the actual problems in the units, with which the psychiatrist therefore needed to be in close touch. The official attitude, however, was that the presence of the psychiatrist would encourage psychiatric casualties rather than prevent them. That there was an element of truth in this claim was borne out by American reports on psychiatric activities; the emphasis on lack of blame attaching to those who broke down tended to show an easy way out to others in the units. Treatment was far more likely to be successful if it was carried out in the unit than if the patient was removed to treatment centres. Combatant officers found that 80 per cent of those who broke down in the first action could be rehabilitated within the unit—a far more satisfactory figure than any treatment centre could show.

While under combat conditions patients could be treated by sedation, hypnosis, simple supportive psychotherapy, attention to physical needs, and in some cases by insulin and electro-convulsive therapy. Once the patient had been removed from the fighting line there was more emphasis on psychotherapeutic techniques, with physical therapy in a subsidiary role. When he arrived at the base area, social work became prominent, and personal and family problems were attended to. Psychotic patients in the base areas fell into one of three classes: those who could be cared

for in out-patient clinics; those who could be treated in a general hospital; and the most seriously ill who had to go into a mental hospital. The Repatriation Commission aimed to keep facilities in mental hospitals at the level of those in general hospitals. It advocated the "total push" system of therapy: a combination of individual and group, occupational and recreational therapy. As the mental hospitals were under State control the commission's social workers were not on the staff but were allowed to act as consultants.

The prognosis for psychotic states was most satisfactory, and certification was very rarely necessary, a circumstance due more perhaps to the nature of the illness rather than to any specific treatment. All psychotic patients, however, required the care of a team consisting of a psychiatrist, a clinical psychologist and a psychiatric social worker. Because of the shortage of psychiatrists it was sometimes necessary to rely on group therapy. This was moderately successful, but the number of psychiatric social workers was so small that the total benefit was negligible. The Red Cross made a notable contribution, but its resources were too limited and the problem was one that should, as Stoller points out, have been an integral part of army organisation.

The value of the psychiatric social worker lay in her function of promoting an understanding between the patient and his family, and in explaining the illness so as to remove the stigma often attached to mental disease, and enlisting the help of the family in bringing the patient back to a normal community life. Under the direction of the psychiatrist she was able to deal with the various personal and social problems—including unemployment and housing—and so remove some of the factors contributing to the mental condition. Follow-up was an important part of the team's activities: it helped to consolidate the patient's cure, and also made it possible to evaluate the benefit of various forms of therapy.

Professor Willard Waller has pointed out that the community has a heavy responsibility to the ex-serviceman requiring rehabilitation. When war comes the civilian is efficiently and rapidly turned into a soldier; he is taught to look out for himself as best he can while conforming with army life; he does as he is told and does not have to regulate his behaviour by his own moral standards; he is cut off from all the influences that have contributed to his character. When peace comes there is no one to teach him how to be a civilian again; he must make the effort—which will often be a considerable one—to resume responsibility for his own actions, and to live by his own personal standards. That the disrupted family unit has also to reorder its life is an added difficulty.

Rehabilitation of Service medical officers. The special factors concerned with the return of Service medical officers to civil life on demobilisation were under close consideration by the Service medical directorates during the later phases of the war. Though clinical experiences of medical officers gave them certain opportunities to advance knowledge in special fields, it was clear that the undoubtedly high standard of Australian medicine must

suffer to some extent during a long war. Recent graduates were under a special disadvantage. The medical course had been reduced in all universities from six to five years; the strain on depleted teaching staffs was severe; hospital residencies were curtailed in duration. Moreover, military duties were often concerned with fields quite remote from civil practice; graduate studies, though warmly encouraged where possible during the war, were restricted; interchange of eminent teachers from other countries was minimal, and medical literature was meagre in quantity and reduced in scope. In addition, some of the wartime researches had produced new methods and techniques which demanded special study. It was therefore greatly to the advantage of medical servicemen and to the general public that a wide and intensive study should be devoted to the raising of professional standards to their previous high level. The D.G.M.S. of the Army, General Burston, had been trying since 1943 to obtain financial help for medical officers wishing to undertake post-graduate work before resuming practice, and was successful, on returning from overseas in 1945, in getting the Department of Post-war Reconstruction, the Universities Commission, the Treasury and the Repatriation Commission to recommend three months' leave on full pay to doctors who had enlisted within two years of graduation.

Medical officers on demobilisation enjoyed the same privileges as other servicemen returning to civil life, for whom the Department of Post-war Reconstruction published a brochure. In addition they were helped by the State Coordination Committees, their local branches of the British Medical Association, and the State post-graduate committees. Pre-discharge training was organised whereby a medical officer could take a refresher course. Such training could be part-time or full-time, and arrangements could be made for residence in hospitals. Scholarships and fellowships, and assistance for research, were also available, and opportunities for work overseas. The Universities Commission assumed responsibility for training and for the fees incurred.

In 1945 Burston, while in the United Kingdom, was able to obtain from the Nuffield Foundation fifteen travelling fellowships for former medical officers of the three Services. These provided £400 sterling a year and the cost of the passage to and from the United Kingdom. While in the United States of America Burston was also able to arrange for a grant of 30,000 dollars from the Carnegie Corporation to provide fellowships for members of the staffs of teaching hospitals who had been serving with the forces. These fellowships gave opportunity for several months' post-graduate work abroad as a preparation for resumption of their teaching appointments. The Rockefeller Foundation also made available four research fellowships to provide one or two years' post-graduate training in America or Britain. The National Health and Medical Research Council in Australia appointed a sub-committee to select suitable holders of these appointments. Promise of further assistance in higher medical and surgical training was given by both the Nuffield and Rockefeller Foundations. The Australian Red Cross Society set aside funds sufficient to send

some twelve recent medical graduates abroad for a year's post-graduate study, and the Royal Australasian College of Surgeons provided five Gordon Craig travelling fellowships. Australian hospitals arranged to take agreed numbers of medical officers as resident medical officers for variable periods, and correspondence courses were available on subjects of general and special medical-scientific interest and importance, including those required for examinations for various diplomas. Finally in each Australian university and in numbers of hospitals various post-graduate foundations established before the war were open to demobilised medical officers. Resident medical posts at repatriation general hospitals were restricted to ex-servicemen, including servicemen who took up medicine after the war.

At the wish of the medical officers, the British Medical Association arranged for the *Medical Journal of Australia* to publish the names and addresses of demobilised medical officers, and the dates they expected to resume practice.

After the war the Repatriation Commission gradually assumed the responsibilities that the Services were relinquishing for the medical care of ex-servicemen. The large army general hospitals in the capital cities eventually passed to the commission, and it was therefore unnecessary for the commission to undertake a large amount of building. Provision was made for three or four beds per thousand of all enlistments; two per thousand had proved adequate in the period between the wars. Immediately after the war extra hospital accommodation was required for the large numbers of prisoners of war, and for the investigations and treatment that became necessary on demobilisation.

Special hospitals were provided by the army at Bonegilla for the treatment of tuberculosis, and at Kenmore Mental Hospital, Goulburn, for mental cases. Existing accommodation of this kind in repatriation hospitals was inadequate, and it was considered that at least 700 more beds in proper installations would be needed for tuberculosis patients and 500 for mental patients. It was not possible to take over the specialist army hospitals for treating these conditions, because the psychiatric section was housed in a hospital to be returned to the New South Wales Government, and the one at Bonegilla was a collection of temporary huts. A steady, though extremely slow, building program was begun and after some years of makeshift and overcrowding a reasonable standard of accommodation for these patients was achieved.

Post-war malaria. The task of continuing the fight against malaria in the post-war years fell to the Repatriation Commission, and the story of how this disease, which could have become endemic in certain areas in Australia, was wiped out is one revealing good planning, foresight and cooperation.

In 1945 when general demobilisation began, the Repatriation Commission was already adequately prepared for this task. Continuous liaison had been maintained with the army regarding all developments in the

treatment and suppression of malaria. A Repatriation Local Medical Officers' Service operated in all towns throughout the Commonwealth, and all Repatriation local medical officers were issued with instructions about the treatment of malaria, and with supplies of anti-malarial drugs.

All Services promulgated a General Routine Order, explaining to all ranks how to obtain treatment from the Repatriation Commission if they suffered an attack of malaria after discharge. Similar information was given in the booklet *Return to Civil Life,* issued to each serviceman on discharge, and the representatives of the Repatriation Commission at the discharge centres also supplied everyone who had served in a malarious area with a card which contained full details and which he could hand to a Repatriation local medical officer, or, if necessary, any doctor, when he suffered an attack.

The Repatriation Commission was responsible for the cost of all treatment for the first attack, and also paid the patient an amount equal to the full war pension for the period during which treatment prevented his working.

In the middle of 1946 the Repatriation Commission obtained supplies of the new drug, paludrine, and the battle against malaria entered its last phase. Paludrine was supplied on condition that its use was confined to patients whose blood tests were positive. The Repatriation Commission maintained records of all cases treated with it, as a contribution to the research begun by Fairley at Cairns. It was necessary for a patient to continue to take paludrine twice a week for six months after the attack had subsided, and carelessness or failures of memory would reduce the efficacy of the drug. Ex-servicemen had great confidence in paludrine, however, and the records show that relapses were extremely few. Where they did occur, they could generally be traced to a neglect to take the drug as ordered. In 1948 the word malaria began to be heard less and less frequently in repatriation offices, and in 1949 it joined a number of other post-war distresses that had gradually faded from the scene. Medical science and time had won the battle.

The method adopted for transferring control from the army to the Repatriation Commission was to hand over sections or blocks of wards over a period of months. When administrative control was finally assumed by the Repatriation Department—at Concord this happened in May 1947—the army was in the position of a "lodger unit", and ultimately handed over its wards to the commission. The commission had also to provide its own medical staff, because it was unreasonable to keep A.A.M.C. members in the Service for the sake of attending to repatriation patients.

The convalescent care and training of ex-servicemen with a disability not caused by the war and who were therefore ineligible for benefits under the Repatriation Act became in 1945 the responsibility of the Department of Social Services. As the result of an interim scheme then inaugurated some 11,000 disabled ex-members of the forces were re-established in the civilian community. With this experience behind it the department in 1948

introduced a scheme for civilians, which by an amendment to the Social Services Act in 1955 became known as the "Commonwealth Rehabilitation Service". This was not a complete community service, in that its purpose was confined to helping certain severely disabled persons receiving social service benefits who were thought to be capable of taking their place again in industry and commerce.

Rehabilitation centres were established in all States except Tasmania, with facilities for the treatment of 600 men and women. Physical treatment was given to restore function and on the social side an attempt was made to improve the patient's confidence and skill and will to work; at an early stage a vocational guidance test was given, and a course of study begun which could be continued after leaving the centre. The patient learned to meet the demands of daily living and to become independent both physically and socially. One aspect of the rehabilitation centre which was emphasised by Dr D. O. Longmuir, later of the Department of Social Services, was the socialising value of community living during recovery; patients gained in confidence from living and working together. Dr Burniston, as the Principal Medical Officer of the department, reported in August 1955 that in the first seven years of its existence the service had successfully placed more than 7,000 physically handicapped men and women in employment with great benefit to the national economy. All this was accomplished with knowledge and experience gained during the war and immediately afterwards by doctors who had served in the rehabilitation services of the army or air force.

Dr Burniston has suggested that hospital services should be set up to supplement the Commonwealth Rehabilitation Service so that rehabilitation could, as it should, start from the time the illness or injury began. This has been done in Britain and America and has proved successful both socially and economically.

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